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A FRENCH CYCLE RACING-CAR.—[See page 110.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Truth About the Iceberg Peril

THAT famous craft, the United States revenue cutter "Seneca," Capt. E. E. Johnson, has added one more to the long list of the valuable services which she has rendered to navigation. The "Seneca" it will be remembered was detailed to patrol the ice field during the spring of the present year, locate the position and course of the icebergs, and make a thorough study of this peril and the best means to detect and avoid it. The report of Capt. Johnson shows how well the work was done.

All of the ice seen on or near the Grand Banks this season has been in berg form. The largest berg sighted measured 400 feet long by 300 feet wide and it stood 70 feet high out of the water. All were white in color and no two bore any striking resemblance to each other. The "Seneca" sighted every type and shape of iceberg except the kind popularly pictured in school books, with high, overhanging, craggy pinnacles. The Captain sighted no bergs of the enormous size reported in the newspapers, such as were stated to be half a mile long and 300 feet high. The loftiest berg that he saw was estimated to extend only 150 feet above the water.

The greatest distance at which ice was observed in clear weather by day was eighteen miles. The average berg, on an ordinarily clear day, can be sighted from 13 to 16 miles from the ship; on a cloudy day, from 11 to 14 miles. In a slight fog bergs can be sighted at 2 miles, in a dense fog at 200 yards, and in drizzling rain at 2½ miles. In bright moonlight they can be seen at 2½ miles with the naked eye; in starlight at 1 mile, and at 2 miles distance with glasses. On a night overcast and dark, but with the horizon visible, bergs can be seen at a distance of one half mile with glasses.

With a searchlight a berg can be seen at 3 miles on a dimly moonlit night, and at 2 miles after the moon has set; but the observer must stand 15 feet away to one side of the beam if he would see readily. Capt. Johnson states that with the beam turned on a berg abreast the ship and 2 miles away, he could see it as plainly as an illuminated store front from the quarterdeck when he was standing about 100 feet from the light. It should be noted that the beam must be drawn to a fine focus, and that a flaring beam blinds the observer. Because of its blinding effect, the Captain would not recommend the general use of the searchlight for a vessel under way. Very pertinent is his remark "On a dark night or in thick weather, the vessel in the vicinity of bergs should slow down so as to be able to maneuver within the limits of visibility."

Important, also, is the fact that about ninety per cent of the attempts of the "Seneca" to locate an iceberg by means of echoes gave no results. The existence of an echo indicates the presence of a berg; its absence proves nothing. Usually an echo will be obtained only if the face of the berg opposite the ship is normal. A slanting face will, of course, reflect the sound away. Nor can the temperature of the sea be relied upon as an indication of proximity to an iceberg. No change in the temperature was noted up to within a ship's length of the berg. Again, the "Seneca" found little or no change in temperature of the air near a berg. It was found that in a light, low-lying fog, the observer could see a berg from aloft sooner than from the deck; on the other hand, in a dense fog it was found that the lookout was most effective when it was kept from the spar deck, as the first sight of the berg was the lapping of the water at its base. It was noted that the roar of breakers on a berg and the rumbling of breaking ice could be heard as far as a mile distant on a calm day.

Multi-gun Turrets

IF the question of how many guns it is best to mount in a single turret were left to the decision of the gun-pointer, the man who elevates and fires the gun, he would unhesitatingly pronounce in favor of one gun for each turret. In a single-gun turret the gun is mounted directly above the vertical axis of the turret and the shock of discharge does not tend to rotate the turret to right or left and throw the gun off the target. In a two-gun turret, the axis of each gun is several feet from the vertical axis of the turntable on which the turret rotates. Consequently, the energy of discharge constitutes a powerful moment, tending to rotate the turret—the discharge of the gun to the right of the vertical axis of the turret swinging the gun off to the right, and *vice versa*. It is attempted to resist this tendency by powerful friction clutches; but they are not fully effective and the discharge of one gun is liable to throw its fellow from one to three degrees off the mark. This requires re-sighting and involves delay.

It was the saving of weight both in armor and operating gear that led to placing two guns in a turret; and for many years past this has been the standard practice. It is largely the same consideration that led our navy and those of Italy, Russia and Austria to adopt the three-gun turret. Another compelling motive, which perhaps more than any other is answerable for the introduction of the three-gun turret, is the fact that it simplifies the work of the gun-pointer, by concentrating the splash and enabling him to make a more accurate estimate of the errors in range and traverse. Similar considerations have now led the French naval architects and ordnance officers to go one step further and place no less than four guns in a single turret; and their latest ships, the "Normandie," "Flanders," "Languedoc," and "Gascogne," are committed to this arrangement. Just how great is the saving of weight due to this concentration may be judged from the fact that these ships are to carry twelve 13.4-inch guns and twenty 5.5-inch guns on a displacement of only 25,000 tons. Our own "Pennsylvania," which will mount a battery of approximately the same weight, viz., twelve 14-inch guns and twenty 5-inch guns, is of over 6,000 tons greater displacement; and although the larger part of this increase is due to the greater size of the ship and the heavier armor, it is certain that the elimination of one turret (the "Pennsylvania" carries its main battery in four turrets) with its heavy barbette, operating gear and other structural weights, must account for a considerable amount of the difference.

A serious objection to multi-gun turrets which has been developed at the proving ground tests, has been the fact that the powder blast of the guns tends to throw the shells out of their true path and produces objectionable dispersion. The powder gases, as they burst forth when the base of the shell is clear of the muzzle, still carry a pressure that is exceedingly high—between seven and eight tons; and this blast, impinging on the shells of the adjoining guns, somewhat disturbs the accuracy of their flight. The difficulty can be met in two ways: first, by timing the discharge so that each gun is a small fraction of a second behind the adjoining gun, each shell getting sufficiently clear of the blast of the adjoining gun to be free from interference—a method which is open to the objection of displacement of the turret, already referred to above; secondly, by placing between the muzzles shields of sufficient strength to oppose the lateral dispersion of the gases until the shells are well clear of the zone of interference. If the weights involved are not prohibitive, this would be the better plan. There can be no doubt that the French navy have given to this problem the most careful investigation and are well satisfied as to its efficiency. But it is a bold step; and the innovation will be watched with great interest throughout the navies of the world.

Renaissance of the Bicycle

RECENT statistics presented by the Cycle and Automobile Manufacturers' Association of France suggest that some day there may be a renaissance of the interest and use of the bicycle in this country. According to the reports of the Association for 1912, there were in France at the close of that year 89,185 motor cars, 98,641 motor cycles, and 2,969,985 bicycles. With the exception perhaps of those who are directly interested in the bicycle industry in this country, Americans will be astonished to learn that in a single country of Europe there are nearly 3,000,000 bicycles in use, and that one person in every thirteen owns such a machine.

To those of us who rode the bicycle some ten or fifteen years ago—and who did not?—when the more popular thoroughfares were so crowded with bicycles that they presented the appearance of an endless procession of riders, and when one could not ride either in the busier thoroughfares of traffic or on the outlying roads without having quite a company of fellow wheelmen within sight or within easy reach, the present dearth of bicycles, at least in our larger cities, would suggest that the wheel has practically passed out of use in this country. As a matter of fact, although there has been an enormous falling off in interest, the bicycle as a vehicle of utility still creates sufficient demand to maintain a thriving industry, particularly in the manufacturing centers and in such rural centers as are blessed with fairly good roads.

The American must visit Europe to appreciate the fact that, there, the bicycle has not only held its own, but is increasing in popularity and usefulness. Most surprising will be the degree to which the cycle is used in the very heart of the most populous cities. Strong and serviceable machines, with a complete equipment of mudguards and two or more powerful brakes, are in daily service on the most crowded streets, and are used by a wide variety of people in their daily work. The tradesman, delivery boy and messenger predominate; one also sees mounted postmen, soldiers and even policemen; not the policeman of a mounted corps, as we have them in this city, but policemen who are evidently using the machine to get to and from their various beats. Surprising and very interesting are the fearlessness and skill with which the bicyclist plunges into the thick of the complicated traffic in European capitals, and accidents seem to be comparatively rare. No doubt this is due in a large measure to the spirit of respect with which the bicyclists are regarded by the heavier forms of traffic. Furthermore, Americans will be interested to learn that the bicycle is still extensively used in Europe as a means of pleasure. Thousands of people make use of the machine for touring, and so obtain in a cheap, healthy and most enjoyable way, that initmate knowledge of the scenic beauties of the old world which a bicycle tour makes possible.

As showing that there has been no such abandonment of the bicycle in France as has occurred with us, and that its present popularity is not ephemeral, it may be mentioned that ten years ago there was but one bicycle in France to every thirty persons as against one for every thirteen to-day.

The New Chief of the Weather Bureau

AFTER an interregnum of more than three months, following the summary removal of Prof. Willis L. Moore from his position as chief of the United States Weather Bureau, an admirable successor has been appointed in the person of Prof. Charles Frederick Marvin. This appointment puts an end to a situation that has caused some concern among American meteorologists and other persons interested in the future of official meteorology in this country. It was understood from the outset that this position would be filled on the basis of scientific merit, without reference to politics, and that the President had sought the advice of the National Academy of Sciences before undertaking to make a selection; also that the Academy had appointed a committee which had several names under consideration. However, in contrast to these auspicious arrangements, rumor successively named as the probable appointee several persons whose qualifications for the post were by no means obvious. Apparently meteorological attainments were to be the least influential consideration in filling the most important meteorological post under the Government!

Happily the danger of a misfit appointment has been averted. Prof. Marvin has been connected with the national meteorological service for nearly thirty years, having entered the service as a junior professor in 1884. He is known all over the world as an inventor of meteorological apparatus, and has been a voluminous writer on the theoretical as well as the practical side of instrumental meteorology. In recent years he has devoted special attention to improving the meteorographs used in connection with kites and balloons for exploring the upper air; to perfecting hygrometric apparatus and methods; to the calibration of anemometers; to the measurement of evaporation; and to the improvement of pyrheliometers. Prof. Marvin is a very hard worker—a man of singular modesty and approachableness. The Weather Bureau and the public it serves are to be congratulated.

A Bulb-digging Machine is a long-felt want in Holland, and the American consul at Amsterdam reports that the General Society for Bulb Culture, with headquarters at Spaarne 71, Haarlem, offers a prize of 1,000 florins ($402) for the best contrivance of this character. At present the vast number of tulip, hyacinth and other bulbs grown in the region between Haarlem and Leyden are scooped out of the ground with the hands, a tedious and laborious process.

Engineering

Phenomenal Traffic Through Sault Ste. Marie Canal.—Twice during the present year, all previous records for a single month's commerce through the American and Canadian canals at Sault Ste. Marie have been exceeded. In May the freight movement amounted to 11,307,000 tons, and this was exceeded in June, when the freight that passed through the two waterways reached an aggregate of 12,113,613 tons.

Improvement of the Welland Canal.—The Welland Canal, connecting the St. Lawrence with the Great Lakes, is undergoing improvements of such magnitude that they will total about $2,000,000 per mile. The canal, which is 25 miles in length, traverses a lofty divide over which it is necessary to raise vessels to a total vertical height of 326 feet. The new work of improvement, taken in connection with the deepening and widening of the St. Lawrence channel, will have a most important effect on the problems of movement of freight from the Northwest to the Atlantic seaboard.

Our Excellent Coastwise Shipping.—The fact that two new steamers 432 feet in length and of 7,000 tons gross tonnage are about to be built by the Newport News Shipbuilding and Drydock Company to ply between New York and Galveston, draws attention to the flourishing condition of our coastwise shipping. The wisdom of Congress in giving complete protection to our coastwise trade is shown in the size of the fleet devoted to this service, in the fine character of the vessels employed and the general excellence of their equipment and navigation.

Two Hundred and Fifty Ton Crane for the Panama Canal.—The contract has been let to a German firm, Deutsche Maschinenfabrik A. G. of Duisburg, for the construction of two large floating cranes of the revolving type, which are to be capable of lifting 250 tons. They will be used for handling lock parts, and the various heavy loads incident to the work of maintaining and operating the Panama Canal. The pontoon measures 88 feet wide by 150 feet long and the crane can lift 250 tons at 22.3 feet from the side of the pontoon; 150 tons at a distance of 62.4 feet, and 100 tons at 81.6 feet beyond the pontoon.

The Renaissance of Messina.—It is gratifying to learn that the town of Messina, whose overthrow by earthquake is fresh in our memory, has been so far rebuilt and repopulated as to warrant the construction of a system of electric railways. The two lines, one of which starts from Piazza Pittoria and one from Villa Mazzini, will give the city a comprehensive system of transportation with terminals at the railway station and the ferryboats. In addition to the city lines, extensions will be carried well into the adjacent suburbs. The system as now planned will have a total length of about 50 miles.

Cape Cod Canal by June, 1915.—A year's extension has been granted for the completion of the Cape Cod Canal, which is now due to be opened in June, 1915. This will be the first link in a chain of inland waterways which it is hoped will ultimately extend from Boston, Mass., to Beaufort, N. C. The route will include Long Island Sound, New York Harbor, the Delaware and Raritan Canal, the Chesapeake and Delaware Canal and a system of canals south of Norfolk. A bill is now before Congress which seeks to have the Federal Government purchase the Chesapeake and Delaware Canal and enlarge it sufficiently to meet the needs of coastwise service.

Railway Construction in 1911.—Statistics issued by the Bureau of Railway News and Statistics show that the United States led in the matter of total amount of railroad construction during the year 1911, during which the total amount of new railroads constructed in the world was 17,151 miles, of which 5,394 miles was built in the United States. Europe built 3,100 miles, British East India 2,399 miles, Africa 2,232 miles, Argentina 1,860 miles, Australia 864 miles and Canada 620 miles. At the close of 1911 the total railroad mileage of the world was 655,842 miles, and at that time the United States contained 246,000 miles of track, as against 210,000 miles in Europe.

All New Haven Locomotives to be Superheated.—The advantages of superheating the steam in its passage from the boiler to the cylinders are so well proved and valuable, that the superheated locomotive bids fair ultimately to become the standard type on American railroads. We are informed by the New York, New Haven and Hartford Railroad that they have decided to equip all of their locomotives with superheaters. The locomotives will be converted at the rate of five per month. Fifty new Pacific type locomotives recently purchased by the New Haven Company are all of this type and about 350 locomotives in all are to receive the benefits of the new device. Not only will superheating effect a saving of about 20 per cent in fuel and 25 per cent in water, but the company estimate that the hauling power of the locomotives will be increased also about 20 per cent.

Electricity

Maturing Cheese Electrically.—A British trade paper reports that an electrician of Rotterdam has discovered a method of maturing cheese by electricity. The method consists in subjecting fresh cheese to an alternating current for 24 hours, which treatment results in giving to the cheese all the properties hitherto acquired by aging.

Cost of Lighting Motor Cars.—In order to determine just how much power is used by electric lighting systems of automobiles, tests were recently conducted at the Indianapolis Motor Speedway. Standard cars were used in the test and they were run as far as possible on a single gallon of gasoline with the electric generating apparatus disconnected. The same car was then run as far as it would go on a gallon of gasoline with the generating apparatus connected, and the difference in distance traveled showed what proportion of the fuel was consumed in driving the generator. It was found that for higher power cars the fuel consumption for the electric system amounted to 7.3 per cent and for the lower power cars 10.77 per cent.

New Method of Sealing Conductors in Glass.—Writing in the *Electrician* (London) George B. Burnside describes a new method of hermetically sealing electrical conductors through glass and other vitreous substances. An aperture is formed in the glass, just large enough to receive the conductor, and after the conductor has been inserted the glass is strongly heated by means of a blow-pipe flame, until perfect cohesion has been obtained between the glass and the conductor. The seal is then taken out of the flame and when it reaches a dull red heat it is cooled by several immersions in a bath that may consist of sperm, or other oil, wax or fat, previously warmed. Each immersion should last about two or three seconds until the seal is completely cooled. In this way local differences of temperature are avoided and hence there is no cracking of the glass around the conductor. If a large conductor should be used it should preferably be sealed in place in the form of a tube which may subsequently be filled with a conducting substance.

Electrifying German Railroads.—As a result of tests made on a 15-mile section of the Magdeburg-Halle Railroad, the administrations of Bavaria, Baden and Prussia have decided to use the high-tension single-phase system, employing also a low frequency. In the test the electric locomotives covered as much as 25,000 miles and showed a very good performance, so that it has now been decided to use the same system in the proposed scheme for the suburbs of Berlin, covering no less than 250 miles of double track and costing $30,000,000. From another source we learn that electric traction will probably be adopted on the Magdeburg-Leipzig section, which is about 100 miles long, and another extensive project relates to the Lauban-Königszelt line in Silesia, covering 80 miles of direct line and 90 miles of branch roads.

Resistance of Tungsten at High Temperatures.—Accurate measurements on the electric resistance of tungsten at high temperatures are made by Pirali, and he uses a strip of this metal 2.4 inches long, 0.05 inch wide and 0.002 inch thick, mounted in an exhausted bulb. The strip is soldered to a pair of very fine wires as a support so as to have the heat radiation uniform, such as is not the case where the filament is attached to the support of an ordinary lamp, for the support carries away heat from the ends of the filament and makes these cooler than the remainder. He takes the temperature of the tungsten strip by using a Holborn pyrometer, and finds that the ratio of the resistance at high heats to the resistance in the cold at 20 deg. Cent. (taken as unity) is 7 for 1,200 deg. Cent., 10 for 1,600 and 12 for 1,900 deg. Cent.

A Curious Electric Plant is used in connection with the old hydraulic plant on the Seine known as the "Marly machine." The original water wheel and pump plant was put in at the time when Louis XIV built the chateau of Versailles, in order to elevate the water needed for the numerous basins and fountains, but it was remodeled in 1856 by the use of more modern water wheels and machines, employing 40-foot undershot wheels, five in number. But as part of the water had to be used for the city drinking supply of Versailles, the Seine was employed only for power and purer water was sought in a number of large wells sunk in the vicinity within recent times. Portable engine groups were installed at the mouth of the various wells in order to raise the water to the surface previous to sending it to the main pumps. However, within a recent period the engineers found that the Seine itself could be called upon to furnish the power for this purpose as well, so that in an adjoining building there were installed two 150 horse-power turbines fed by Seine water, and each turbine drives a 3,000-volt alternator. This current goes over lines to 50 horse-power motors at the well mouths for driving the pumps, so that the steam engines are only needed on rare occasions when freshets in the Seine lower the head of water and prevent the turbines from running.

Science

A New Honor for Wassermann.—Prof. von Wassermann has been appointed superintendent of the new Kaiser Wilhelm Society for Experimental Therapy at Dahlem, which was founded by the Kaiser Wilhelm Society for scientific research.

Memorials to Schiaparelli.—A committee comprising the heads of leading Italian scientific institutions and presided over by the King of Italy has been formed to obtain funds by public subscription for paying suitable honor to the memory of the late Prof. Giovanni Schiaparelli, the distinguished astronomer. It is proposed to erect a monument to him at his birthplace, Savigliano, in Piedmont, and to place a memorial tablet in the Brera Palace at Milan. He was connected with the Observatory of Brera for forty years, most of that time as director. To the world at large Schiaparelli was chiefly famous for his discovery of the so-called "canals" of Mars in 1877.

The Study of Mountain Snowfall.—Our attention has been called to the fact that a note on "The Economics of Mountain Snowfall," published in our Science Notes column of January 11th, 1913, was somewhat ambiguously worded, with the result that credit appeared to be given to the Weather Bureau for discoveries concerning the relation of certain types of forest cover to the conservation of snow on mountains. As a matter of fact, we are not aware that the Weather Bureau lays claim to any such discoveries. The pre-eminent worker in this field is Prof. J. E. Church, Jr., of the University of Nevada, and it was the results attained by him that we summarized in the pertinent portion of our note.

A German Observatory in the Far East.—The Imperial Observatory at Tsingtau, capital of the German colony of Kiaochau, China, is rapidly becoming one of the leading scientific institutions of the Far East. Originally founded chiefly for nautical purposes, it now carries on regular work in terrestrial magnetism, seismology, astronomy (including time-service), tidal observations, adjustment of compasses, chronometers, etc., and, above all, practical meteorology. The observatory receives telegraphic weather reports (partly by wireless) from a large number of stations in China, Japan, Korea, and Siberia; also wireless weather reports from all German war vessels on the Asiatic station. Daily weather maps are published, forecasts issued, and storm warnings displayed. When a typhoon is reported on the adjacent seas the observatory keeps in constant communication, day and night, by wireless with German men-of-war, and is thus enabled to follow the progress of the disturbance with great accuracy.

The Chinese Wood-oil Tree is the subject of a circular by David Fairchild recently published by the U. S. Bureau of Plant Industry, the purpose of the publication being to advocate an extensive cultivation of the tree in this country, where it has been grown in a small way since 1906. The importance of this recommendation is shown by the fact that five million gallons of wood oil (also known as tung oil), made from the seeds of this plant was imported from China last year, and the product is said to have had a revolutionary effect on the varnish industry of the United States. It has, says Mr. Fairchild, largely taken the place of kauri gum and has made possible the manufacture of a quicker drying varnish, which is less liable to crack than that made from kauri gum, and has been found of special value in waterproof priming for cement. The tree is climatically adapted for cultivation in the Southern States, and the Department of Agriculture is distributing one-year-old specimens to *bona fide* experimenters.

Dr. Babcock's Retirement.—Dr. Stephen M. Babcock, for twenty-five years professor of agricultural chemistry at the University of Wisconsin, and the inventor of the famous milk test which revolutionized dairy methods twelve years ago, has retired from active work with the appointment as Professor Emeritus of the university. The milk test, which is a method for the accurate determination of fat in milk, is not Dr. Babcock's only invention. Among his other donations to science are a viscometer for testing the viscosity of oils, a gravimeter for analyzing milk and a method of chloroforming milk to produce a ferment, called galactase, which is used to ripen cheese. As the result of one of his investigations he discovered that the liquids produced by living plants and animals are not wholly waste products but subserve a useful purpose through which, for example, the ascent of sap in trees and the succulence of fruits is explained. Another of his investigations led to the deduction that "the weight of a body is an inverse function of its inherent energy." Declaring that the results of his work belonged to the State which he was serving and not to himself or to any other individual, Dr. Babcock has always refused to take out a patent on any of his inventions. Many of his discoveries have proved of great economic value.

Another Contest for the "America's" Cup

The Return to Yachts of Moderate Dimensions and Wholesome Type

THE New York Yacht Club has recently announced that the Royal Ulster Yacht Club has signed the conditions for a match for the "America's" cup, and that the first race will be sailed Thursday, September 10th, 1914, the second, September 12th; the third, September 14th; other races which may prove to be necessary to be sailed on each following Thursday, Saturday and Tuesday. Thus this famous trophy, the best known and most valued yachting prize in the history of this great sport, after remaining for eleven years in the undisturbed possession of the New York Yacht Club, is again to be made the object of a memorable contest.

During the past three decades there have been eight series of races for the "America's" cup, all of which have been won by the defending yacht. The races were as follows: "Genesta"—"Puritan," 1885; "Galatea"—"Mayflower," 1886; "Thistle"—"Volunteer," 1887; "Valkyrie II."—"Vigilant," 1893; "Valkyrie III."—"Defender," 1895; "Shamrock I."—"Columbia," 1899; "Shamrock II."—"Columbia," 1901; "Shamrock III."—"Reliance," 1903.

In these races the time allowance which the larger yachts gave to the smaller was determined on the basis of their waterline length and sail area. Each designer was restricted to a waterline length not to exceed 90 feet. So long as he kept within this length, he was at liberty to make his yacht as broad and as deep as he pleased, and spread above her hull as great an area of canvas as he thought fit. During these thirty years of competition, the operation of this rule produced a very extreme type of boat, with great beam and length on deck, of extreme draught, and carrying an enormous sail spread, requiring a very large crew for its handling. The effort to carry the largest possible sail spread showed itself both in the form of the hull and the materials for construction of both hull and spars. The extreme form of yacht produced is well illustrated by the "Reliance," which, on a waterline length of 89 feet 8 inches, had an over-all length on deck of about 145 feet, a beam of 27 feet, and a draught of about 20 feet. In cross-section, the hull presented the appearance of a shallow champagne glass; the hull being shallow, with a flat floor and hard bilges. The hard bilges were carried well out into the bow and stern sections, with the result that when the vessel heeled, she immersed a longer waterline, the original 90 feet being extended to fully 105 feet at a heel of 20 degrees. The use of special steel for the framing and thin Tobin-bronze sheets for the plating enabled the designer to reduce the hull weights and proportionately increase the mass of lead at the bottom of the keel. A further increase of the lead ballast was made possible by the substitution of hollow steel masts and spars for those of solid wood. Such construction enabled Herreshoff to place about 95 tons of lead in the keel of the "Reliance" and to spread above her hull the enormous area of 16,247 square feet of canvas.

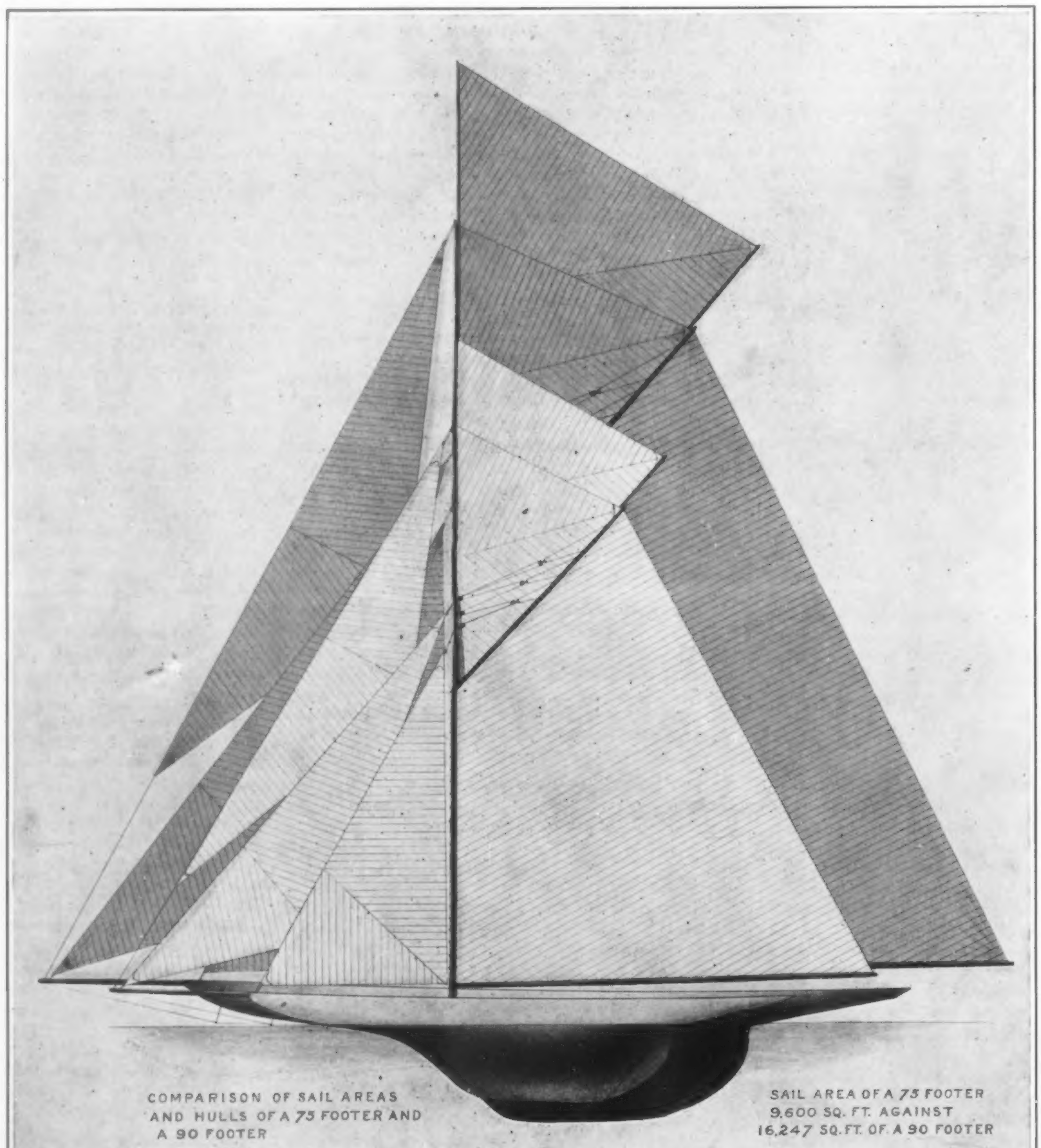
Now such a ship as the "Reliance" not only costs about $150,000 to build, but her running expenses are proportionately heavy. She requires a crew of fifty or more men effectively to handle her; she is an uncomfortable boat in a seaway; and after a series of races is over, she is useless for ordinary cruising. The fate of a yacht of this character is usually that she is broken up and sold for the value of her metal.

During the past few years American yacht clubs have adopted a new rule of measurement, which has produced a type of yacht that is practically as fast as the older type, and which has the advantage that her hull is deeper, more commodious and better suited for cruising. The old rule of waterline length and sail area produced a boat of very small displacement in comparison to the great spread of sail—a most undesirable combination. The new rule favors displacement and produces a boat with a deeper and fuller underwater body, and sharp ends, as against the full overhanging ends of the older type.

The contending yachts built for the last four series of races have been of approximately 90-foot waterline length, and in the preceding four series of races the waterline length was about 85 feet. Now before the length-and-sail-area rule had got in its pernicious work of producing freakish boats of enormous sail area, a boat of 85 to 90 feet waterline carried a sail spread of from 9,000 to 11,000 square feet, and such boats were reasonable in price and in cost of management, and were readily handled. When the exaggerated dimensions of the "Reliance" were reached, the cost and trouble of building and managing these yachts became very serious indeed. A return to yachts of smaller dimensions, such as contended for the cup in the seventies and sixties, became desirable. The British challenge sent by Sir Thomas Lipton through the Royal Ulster Yacht Club gave the length of the challenging yacht as 75 feet. Now a 75-foot modern yacht carries a sail area approximately equal to that of the 85 to 90-foot yacht of 20 years before; and she is sufficiently large to provide a thorough test alike of the skill of the designer, the builder, and the competing skippers and crews. At the same time the cost of construction is cut in half, and so is the cost of operation. Moreover, under the new rule a yacht is built which after the races are over can be cross-bulkheaded and turned into a fast and thoroughly serviceable cruiser.

The accompanying superposed drawing of a typical modern 75-foot racing yacht and of the "Reliance" shows at a glance what an all-round reduction in size and increase in handiness is secured by a reduction of 15 feet in the waterline length. As compared with the "Reliance," the over-all length on deck is reduced from about 145 to 105 feet, the beam from 27 to 20 feet, the draught from 20 feet to 13 feet 9 inches, and the amount of costly lead that must be molded into the keel to give stability is reduced from 95 to about 37 tons. The main boom is reduced from 115 feet to 84 feet and the height from boom to topmast drops from 155 feet to 111 feet. The cost falls from $150,000 to $80,000, and the cost of running the two types is as two to one.

As to the prospects of our retaining the cup in this country, it must be admitted that the reduction in the size of the competing yachts is rather favorable to the challenger. In the first place, for the past decade racing among the large single-stickers has been confined in Great Britain mainly to yachts of from 60 to 70 feet waterline length; and, in the second place, Nicholson, who is at work on the challenger, is one of the younger designers who has shown originality and skill, his later yachts having made a pretty clean sweep in the regattas of the last two years. As far as can be learned, no positive steps have as yet been taken to build a defending yacht in this country.



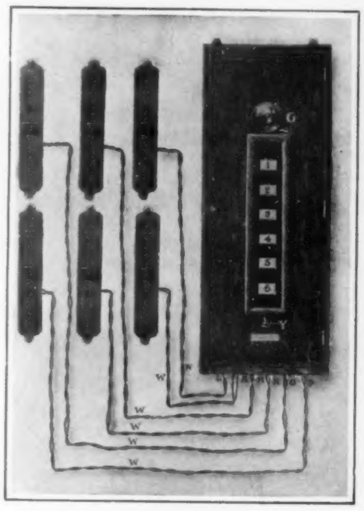
The larger yacht is the "Reliance," the last cup defender; the smaller is a typical 75-foot racer.

Comparison of a 75-foot with a 90-foot racing yacht.

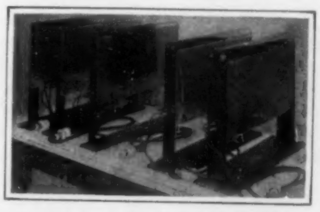
Some Novel Electrical Devices

By Frank C. Perkins

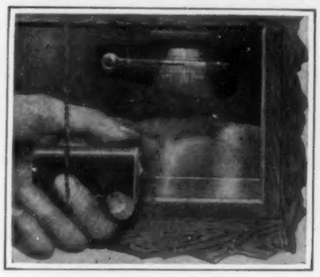
FROST ANNUNCIATOR.—To guard against Jack Frost's occasional visits to orange and lemon orchards, it is the custom to have smudge-pots ready to be lighted at a moment's notice. Very frequently some sections of the orchard experience a much more decided drop in temperature than others on a different level, and hence thermometers are usually located in different sections of the grove, and it is necessary to have a watchman visit them at different hours of the night. At best, frost fighting is not a pleasant job, but to maintain a force of men to meet the emergency, to have them rush out into the cold, dark night filling and lighting smudge-pots, burning fuel that has cost money, only to find that the alarm was based on faulty, unreliable information, is an experience to try a man's soul. Recently an electric annunciator system has been devised for use in such situations. Thermometers provided with means for breaking an electric circuit when the mercury column falls below a predetermined point, are placed in various parts of the orchard and connected to an annunciator in the owner's or keeper's bedroom. If the thermometer falls to the danger point anywhere in the orchard, the alarm bell of the annunciator is rung and the location of the danger spot is indicated on the annunciator.



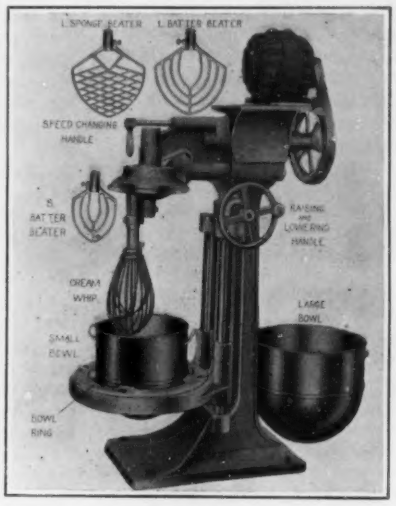
Frost alarm for locating danger in fruit orchards.



Forming irons for book-binding.



Electrically lighted incubator thermometer.



Electric cake-making machine of three different speeds.

ELECTRICALLY LIGHTED INCUBATOR THERMOMETER.—The difficulty of reading an incubator thermometer in the darkness of the machine is obviated by providing a small electric lamp which lights up the scale of the thermometer, brilliantly illuminating the figures, and showing sharply the end of the mercury column. The device is movable so that it may be adjusted to light up any part of the scale desired. The battery of the lamp is placed outside of the incubator, and by pressing a button the thermometer lamp may be lighted. In addition to this there is an electric alarm bell arranged to give an audible signal when the temperature of the incubator is too low or too high.

ELECTRIC FORMING IRON FOR BOOKBINDING.—Pictured in the accompanying illustration are some electric forming irons for bookbinding, which possess the advantage over the ordinary steam iron of being completely portable. The irons are provided with curved tops of diameters suitable for the various sizes of books to be formed. The heat is applied at the top only, so that there is no waste of heat and, of course, none of the annoyances connected with fuel heating. The electric heater has a six-foot cord for attachment to a lamp socket, and the cord is removable at the heater. The energy consumed is from 90 to 180 watts each, according to size.

THREE-SPEED ELECTRIC CAKE MACHINE.—A novel electric machine for cake mixing and beating is illustrated herewith. This machine will do any work that requires mixing, beating, rubbing, whipping or creaming.

It is used to advantage for passing soups, fruit, cheese, mashed vegetables, and the like, the bowl with contents being easily removed from the machine. There are three different speeds provided to cover all the ranges of work required by a baker or chef, and while the machine could easily be arranged for four to six speeds, it has been found that more than three speeds are unnecessary and confusing. The different parts of the machine are clearly designated in the illustration, showing to what a variety of uses the machine may be put in the preparation and cooking of materials.

A New Baseball Indicator

By Guy E. Mitchell

WHEN the World's Series is played in October between the two championship teams of the National and American leagues, the fans of the two winning cities as well as in the other cities of the leagues will be able to witness every move and every act of the star players through a device which was patented last February by Thomas H. Jackson of Scranton, Pa., and which has been in operation for the past two or three months at Atlantic City, Washington, D. C., Rochester, N. Y., and at Mr. Jackson's home. This "player" is unlike many of the contrivances heretofore shown, where both players and the ball have been represented by electric lights or colored glass with lights behind them, but is a faithful representation of the game—diamond, grandstand, fences with advertisements on them, the prize winning bull, the scoreboard in center field, and lastly, umpire and players that do everything but talk. These players throw and catch the ball, run the base lines, slide, run after fly balls, hold consultations on the field and quarrel with the umpire to hide their own short-comings.

The diamond with scenery is fairly large, and occupies the full depth and width of a theater stage. In the front are shown devices so that the spectators may keep track of the outs, balls, strikes, runs for the inning, errors, fly balls and in certain plays, whether the runner is out or safe. On either side is the "box score." Inclined to the rear is the diamond proper with two grooves encircling it. In one of these the players move, while in the other the runners move from base to base.

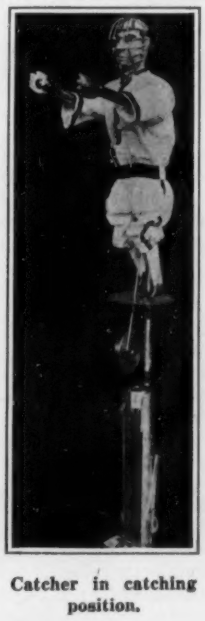
The manikins that enact the plays are themselves about a foot and a half high, but the working mechanism, which is not seen by the spectators, is just as long. This consists of a dry electric cell from which current is carried to a small half-candle-power electric lamp in the hand of the figure. Then through a system of levers the operator is able to raise either right or left arm or both, or cause the figure to bend over. In running bases the wheel attached to the manikin fits the base-runner groove, and in revolving causes the legs to move backward and forward. If the operator wishes to make the figure slide into a base it is necessary only to incline the entire device in the direction desired.

Besides an electrician who operates a switchboard from which hits, flies, and the devices in front are shown, nine men are required to handle the players. One of these men also announces balls and strikes as the plays are made. At the commencement of the game he calls "play ball." The nine fielding players in their white suits come up through holes in the diamond and take their respective positions, and the batter in his brown suit comes up through a hole near the home plate and with bat in hand takes up his place. A light appears in the pitcher's hand—if he is right-handed, in his right hand, and if left-handed, in his left hand. After "winding up" he delivers the balls toward the batter. The light in his hand is extinguished, and if the pitcher is inclined to be wild it is shown in the catcher's hand, the umpire raises his left arm and the announcer calls "ball one." If the batter makes a safe hit—say for two bases to left field—the progress of the ball is shown on the ground from home plate, between shortstop and third base out into left, where the fielder stoops and the light is shown in his hand. He throws to third base, who in turn relays the ball to the pitcher. Possibly the batter was forced to slide into second, but that play is faithfully presented. If, however, the batter merely hit a fly to left field, a light glows over the shortstop's head, then over the head of the left fielder and then in his hand. When the side is out, the manikins in white go down through holes and off the field and their places are taken by manikins in brown, while the batsmen are dressed in white. If, perchance, a pitcher is being hit very hard and is taken out of the box, that fact is faithfully presented by a consultation between the captain of the team and his pitcher and the exit of the latter through a hole near his position in the center of the diamond. If the outgoing pitcher be right-handed and his successor left-handed the difference in delivery is faithfully portrayed as is also the usual position occupied by the batters.

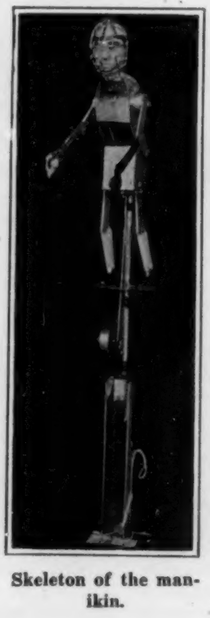
Great enthusiasm is aroused among the fans who witness a game on the board; for they see a miniature player representing their pitching idol strike out batter after batter, or the team's slugger hit the ball to all corners of the field with the fielders in pursuit, or maybe the speedy base-runner stealing bases and sliding beyond the reach of

In the play shown the batter has hit to the second baseman, who throws to third base in order to catch a sliding runner.

Catcher in throwing position.



Catcher in catching position.



Skeleton of the manikin.

the basemen with all the realism of the game. Once the operators become expert there is no play made on the diamond that cannot be reproduced on the device and shown without the need of explanation.

A French Cycle Racing-car

By S. P. McMinn

THE grotesque-looking little car that appears on our front page this week is the French "Bedelia," though it is not the same "Bedelia" that was illustrated and described in the SCIENTIFIC AMERICAN some weeks ago. It is of the same sort, but this particular one was developed primarily for speed, and its makers held strong hopes that it would win the Grand Prix race for cycle-cars, as these little vehicles are styled, which was run off near Amiens on July 12th; but it only succeeded in getting second place despite its elaborate preparation. Notice the narrow tread and the way the driver and his mechanician are seated one behind the other to reduce wind resistance to the minimum; the disked wheels, and the peculiar manner in which the front axle is braced.

Structurally the car is a little bit different from its predecessors of the same name, and in its make-up there are a number of very interesting features. The engine, for instance, is a twin-cylinder air-cooled machine with the cylinders set at 90 degrees to each other and a bore and stroke of 82 and 100 millimeters, respectively. The motor is mounted on rails so that it may be moved fore and aft a certain distance in order that the driver may loosen or tighten the belts through which the car is driven; this movement of the engine is controlled by a worm gear operated by the driver. There is no clutch, properly speaking, nor is there any countershaft, the drive from the engine being taken directly to the rear wheels through two long belts about twelve feet in length. The driving pulleys are mounted directly on the ends of the engine crankshaft and are of a very unusual type. In the larger part of them there are small centrifugal governors, and as the speed of the car advances, these contrivances draw the cheeks of the driving pulleys together slightly, thus increasing the diameter of the driving pulleys and thereby amplifying the gear ratio between the engine and the road wheels. As the speed of the vehicle drops off, the pulleys spread and the gear ratio automatically is lowered; thus it is practically impossible for the operator to "stall" his motor, for gear changes are taken largely out of his hands. He can, of course, shift the engine and permit the belts to slip, and in this way obtain a very low gear ratio, but a very inefficient one withal. No differential is used, quite as a matter of course, for in rounding curves one of the belts slips slightly, thus compensating for the difference in speed of the driving wheels. Throughout the whole of the construction the aim of the designer has been to obtain the very lightest weight consistent with strength, and to this end the frame is drilled out wherever possible. Steering is done by means of steel cables wound around a bobbin much after the manner of the typical marine steering gear. Two cables are used, one heavy and one light, and both are passed through fiber tubes where there is any likelihood of chafing. If the heavy cable, which is the one normally in use, should be broken through accident, the lighter one then comes into play; virtually, it is nothing more than an emergency rig.

Millions for Naval Armor—the Remedy

By Louis E. Browne

ARMOR plate for modern dreadnoughts costs the United States one third of the whole amount appropriated for the construction of the vessel. It is the most expensive factor which goes into the make-up of the mighty battleship, and its production is limited to just three plants in this country. Armor costs the Government $454 per ton, and the required 10,000 tons needed for one ship or the 20,000 tons needed for two ships, as the case may be, is equally divided into work for the three steel plants, resulting in an approximate cost to the nation of $4,540,000 for each ship placed in commission.

Josephus Daniels, Secretary of the Navy, has determined upon a policy looking to the ultimate establishment of a naval armor plant. In a letter to Congress he said that if Congress authorized a plant large enough to produce 10,000 tons per year, or half enough for a two-battleship programme, the cost of the plant would be about $8,466,000 and the saving in the cost of armor plate would be about $140 per ton on the price of $454 now paid. Thus, according to his estimates the United States would save $1,400,000 on 10,000 tons of armor or the yearly output.

The naval service is divided in opinion as to the advisability of the Government plant. Mr. Daniels frankly stated that many problems must be solved before the wisdom of such a plant could be reached, and that at present no accurate figures are available.

Because of the expensive machinery, the Secretary of the Navy, in a letter to Congress, says that the armor plate industry is susceptible to monopoly. Investigation shows that foreign governments pay their armor plate manufacturers a higher price for armor than does the United States. Three governments in Europe have established national armor plate factories with the result of great saving. They are France, Russia, and Italy. England and Japan are contemplating governmental plants.

All armor for the Navy is to-day made in the Carnegie, Midvale and Bethlehem plants at practically their own prices, states Mr. Daniels. He further stated that the records clearly show that the manufacturers, convinced that one third of the work is coming to them without reference to the price they bid, have usually submitted bids nearly identical. In the past they have received one third the work anyway, whether high or low bidders. If one bids much lower than the rest, the other two companies have been awarded their share at the figure of the lowest bidder. The Secretary of the Navy makes these assertions upon the authority of letters received from the Midvale Steel Company and the Bethlehem Steel Company.

Special machinery of extremely costly nature is required to manufacture armor plate more than 1½ inches in thickness. The three named companies are practically the only ones in this country having the necessary machinery.

Since John Stevens of Hoboken, N. J., proposed armor for war vessels in 1812, the art has advanced to the present high state of perfection.

The object of the modern hard-faced super-carbonized armor is a metal homogeneously hardened as hard as, if not harder than, the projectile, and at the same time so tough as not to be shattered by the terrific impact. This armor comprises a series of operations which require the greatest care and attention to detail, and usually after receiving the drawings, nine months are required to turn out the finished article.

Fourteen operations are necessary—casting the low-carbon ingot, stripping the ingot, removing the scale, rough-machining, carbonizing, scaling, reforging, annealing, machining, bending, tempering, rectifying and finish-machining, and erecting. Tests are required after forging and tempering. The ingot is placed in a 50-inch double forging press, and while at red heat subjected to a hydraulic pressure of about 14,000 tons. Then the plate is carbonized. This is an adaptation of the long known process of cementation, which means heating the metal to a high degree of heat in the presence of carbon until the carbon is gradually absorbed into the surface. In bending great care must be exercised, and none but the most skilled artisans operate the huge bending presses, which exert a pressure of 7,000 tons on the plate.

The plate is then heated and sprayed with cold water, at a pressure of 23 pounds to the square inch. The plate usually warps and becomes distorted under the treatment, and even under the most skilled treatment the plates usually have to be rectified. In the Krupp armor characteristic cracks, sometimes one quarter of an inch wide, appear, but under the Harvey process smoother plates are produced.

It is the final machining and rectifying that costs so much money. Besides being bored and smoothed, the armor has to be fitted to each piece which goes into the armor belt and turrets of a ship. It is like a jig-saw puzzle. Little grooves here and there, a notch in one end and an over-lap in the other, and finally the determination of the accurate centers of the holes for the armor bolts, require the constant attention of half a dozen skilled men for six or eight weeks on each piece of armor.

The Secretary of the Navy has faithfully studied the armor problem and is about ready to submit to Congress some definite idea of the extent of the plant. He holds that with a national armor plant, the Government could determine the accurate cost of armor and then, knowing the cost, require the private concerns to submit bids, allowing them a fair profit on the work.

Mr. Daniels has submitted a few general facts to Congress regarding the purchase of armor plate by the Government. The actual cost of armor for war vessels of this nation since its introduction is $77,103,482, of which $30,844,153 was paid to the Carnegie Steel Company, $34,215,112 to the Bethlehem Steel Company, and $12,044,217 to the Midvale Steel Company. All companies furnishing steel castings for guns and armor plate in the finished product have in the past furnished the product to foreign nations.

Should Congress authorize the plant, it will be located in Washington near the naval gun factory. Three separate buildings would be needed to accommodate the special machinery. It is the present idea, if the plant is established and proves a success, to later establish a similar plant of the same capacity on the Pacific coast. This would put the Government in a position to manufacture all of its armor. There has been a protest against taking the work away from the civilian plants on the grounds that their capacity would be needed in time of war, but Mr. Daniels replied by saying that should the United States be embroiled in war no warships could be constructed in time to be of service, for the ship could hardly be completed under two years, and it is assumed hardly possible for a modern war to last that length of time.

Ordnance officers in the Navy cite many reasons against the Government plant. First, should the Navy desire advancement in the science of armor, scientists would be needed, and rarely, if ever, has Uncle Sam paid a scientist more than three or four thousand dollars a year, while each of the three companies manufacturing armor for the Navy are to-day paying three or four times that much for several experts. Further, the Navy reserves the right to reject any or all of a consignment of armor, whereas if it were made in a Government shop this loss would fall on the Government instead of on the bidders. Also competition for excellence keeps armor makers striving to excel in the production of their product.

The Electrical Control Boards for the Panama Canal Locks

THE great gates of the locks at Gatun and Miraflores of the Panama Canal will be electrically operated. The control boards, which have been especially designed and built for this purpose, are now on their way from Schenectady to the Canal Zone. In a future issue of the SCIENTIFIC AMERICAN we hope to give an extensive illustrated description of their construction and operation. Suffice to say for the present, that each board is an electrical counterpart in miniature of the lock which it controls. By a very ingenious system of lights and scales the operator can see exactly what is the height of the water in any particular lock and can watch its gradual fall. The boards do not control the lock gates directly, but rather the motors which swing the gates. Readers of the SCIENTIFIC AMERICAN will recall that the lock chambers are 1,000 feet long. Many of the vessels which will use the canal are smaller than this, for which reason provision has been made to divide the chambers into lesser parts for small vessels. This sub-division is electrically effected from the control boards. Particularly noteworthy are the precautions which have been taken to prevent an inadvertent or incorrect operation of the gates. The control handles must be operated in a certain order, automatic locking devices having been provided to prevent their operation in any but the correct manner.

The Current Supplement

IN this week's issue of our SUPPLEMENT Dr. Kunz, the gem expert of Messrs. Tiffany & Company, reports on the new international diamond carat defined as two hundred milligrammes, which will eliminate much confusion from jewelers' negotiations.—T. J. Heller writes on the manufacture of balls for ball-bearings.—J. Blair contributes an article on the Waterproofing of Textile Fabrics.—There are many problems relating to mineral oil still awaiting solution, notably the problem of its origin. An important clue is furnished by the study of the optical activity of the oil, as expounded by F. W. Buschong.—The serious troubles caused by animal growths in the pipes of municipal water supply systems, and the best methods of securing relief, are discussed by S. C. Chapman.—Our Berlin correspondent furnishes an interesting and profusely illustrated article on spiders and their ways.—P. A. Hillhouse writes on "Safety of Life at Sea."—Scenes from the Building Exposition at Leipzig, Germany, are illustrated and described.

Bombs Used Against a Mexican Ship

OPERATING his big biplane under a heavy fire as he circled above the town and bay of Guaymas, on July 28th, Didier Masson, a French aviator, dropped several bombs around the Mexican gunboat "Tampico" lying in the harbor. One of these bombs struck within a few feet of the ship, which probably gave rise to the report that the boat had been sunk. The fact that the aviator operated under fire and escaped unharmed, would seem to emphasize, as has been done on several occasions in the past, that the airship is not to be reckoned with lightly as an instrument of warfare.

Making a Tire Puncture-proof.—A patent, No. 1,062,535, has issued to Thomas S. Causey, assignor of one twelfth to William Dugan, both of Arlington, Texas, for a composition of matter consisting of dextrin, ground asbestos, magnesia, glycerin, wood alcohol and water for preventing leaks in pneumatic tires. A surplus of the composition will tend to maintain a position adjacent the ground during the rotation of the wheel and as soon as the puncture occurs, the air in attempting to escape forces the material into the puncture, blocking the escape of the air.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Sir Hiram Maxim Asks a Question

To the Editor of the SCIENTIFIC AMERICAN:

According to Lowell and some other astronomers, there was a time when this little earth of ours was being boiled at a temperature of 212 deg. Fahr. Of course, this is quite true, but it would be at a time when practically all of the water was on the earth instead of in the atmosphere.

I should like to ask the opinion of some of the scientific men of America as to what was the highest temperature during this boiling process, that is, when the surface of the earth was so very hot that very little or no water remained on it, practically all of the water being in aqueous vapors mixed with the atmosphere; then, again, it is quite possible that the quantity of carbonic acid gas was very great at that time.

Some geologists have told us that about three quarters of the total weight of the earth is made up of limestone. If such be the case, and before any carbonic acid gas was absorbed to form limestone or was transformed into coal, there must have been a very heavy pressure on the surface o' the earth, perhaps a pressure so great that the first water that remained as liquid would be resting on a red hot surface.

If such be the case, it is very evident that we were being very severely boiled at one time, and at a still later date the downpour of hot rain must have been very great indeed. This state of things must have continued for many thousands of years.

I should like to hear what the learned men of America have to say on this subject. What was the maximum pressure and what was the maximum temperature during this boiling process?

London, England. HIRAM S. MAXIM.

The Evils of Price Cutting

To the Editor of the SCIENTIFIC AMERICAN:

As we understand it, the object of the Sherman Anti-trust Law is to prevent combinations in restraint of trade. Strange to say, this law often operates to secure directly opposite results. As manufacturers of proprietary remedies and as wholesale druggists, we labored for years to perfect and put into execution plans that would secure, for the manufacturer of proprietary remedies, the price at which we desired such remedies to be sold and incidentally thus secure a profit to the retailer and to the jobber. To accomplish these ends, it is necessary that the three classes should work together, that is, the proprietor, the jobber and the retailer. This was accomplished and satisfactory results were secured. The Sherman law was then invoked and the work that had been accomplished was declared to be illegal, and since the issuance of what is called the Indianapolis Decree, each member of each of these classes follows his own particular course of merchandising.

The object of the proprietors, in endeavoring to maintain fixed prices for the jobber and for the retailer, was to secure a profit for these two classes, in order that they would, in the first place, stock his goods, and in the next place, have an interest in increasing their sales. The object of the jobber in assisting this plan was to secure a discount sufficiently large to pay the expenses of handling the goods and getting a small net profit. The discounts ranged from 10 and 3 per cent to somewhat more. As the expense of doing business is about 11 per cent, it will be seen that the discount to the jobber was not excessive. The retailer desired this protection so as to enable him to make a sufficient profit on the sales of proprietary remedies to enable him to carry them in stock. Another object to be accomplished by the proprietor was that, if a reasonable profit was secured to the retailer, he would not be tempted to substitute. The successful enforcement of such protection would result in largely increased sales for proprietors and reasonable profits for retail distributors. The outcome of the Indianapolis Decree is that the cutters in the larger cities have been enabled, because of their larger command of capital, to purchase goods at lower prices than neighborhood druggists and to undersell them. At the present moment, the business of a retail druggist is possibly one of the most precarious of retail businesses. The prohibition, therefore, of this combination among the different classes handling proprietary remedies, has resulted in a severe restraint of trade, which restraint is increasing all the time. In other words, owing to the law's prohibition of combination in the sale of proprietary articles, the number of merchants dealing in those articles, in proportion to the population, is decreasing, the business is more and more being concentrated in the hands of large cutters in large distributing centers, and the habit of substitution or of selling something "just as good" is necessarily increasing. The operation of the law has been, so far as concerns the sale of proprietary remedies, to defeat its own ends.

In conclusion, it should be borne in mind that the retail price of proprietary medicines is stated on the label, and at no time has any attempt been made to charge the consumers more than the retail price as fixed by proprietors on their own remedies.

SMITH, KLINE & FRENCH COMPANY.

Philadelphia, Pa. HARRY B. FRENCH, President.

Fireproof Stairways and Elevators

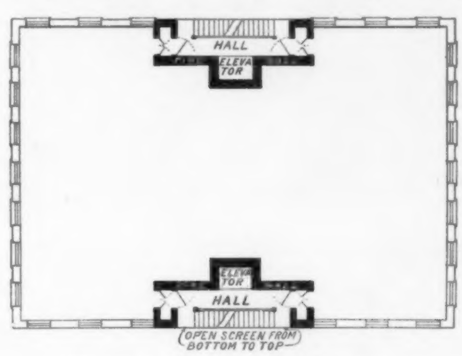
To the Editor of the SCIENTIFIC AMERICAN:

The Binghamton factory holocaust is only the logical sequence of a condition for which laws and ordinances will always be inadequate.

To eliminate all danger of fire, churches, theaters and workshops should preferably be one-storied, but never more than two-storied, and provided, of course, with the necessary means of egress.

Stair-wells and elevators will always act as funnels and propagate the fire and the smoke, even in the best built fireproof buildings.

In high buildings, I would have, as shown in the accompanying sketch of a floor of a factory workshop,



Fireproof stairways, open to street.

all the halls, the stairs and the elevators entirely out on the street.

The stairs would then be efficient fire-escapes, and the elevator, open on the hall only, with no direct opening whatever on any floor, could be operated and save lives during the fire.

This arrangement does not take much more room than the present dangerous one, and precludes the necessity for fire-escapes. E. BECKER.

Washington, D. C.

Suggestions on Utilizing the Power of the Missouri

To the Editor of the SCIENTIFIC AMERICAN:

I notice in the recent issues of your paper that you are discussing the question of more efficiently handling the waters of the Mississippi and Missouri rivers in times of flood. Of course, there will be various suggestions as to the best method of performing this class of public work. I will suggest to you that I have been doing considerable work on the subject of water-power and conservation of these natural resources. In a recent issue of your paper you make the statement that there are times when the Missouri River washes much more sediment into the channel of the Mississippi River in a single year than the excavations amount to in the Panama Canal. If you were to examine the farms in this western country which surround a part of the Missouri River, you might easily see how a large part of this sediment is washed into the Missouri River. I have lived in a country close to the Missouri River for many years, and have noticed the erosion caused by flood waters, where gulches and canyons were washed out deeper, and this wash that was taken out must have been in part delivered to the Missouri River. I have seen small narrow canyons which were smooth in the bottoms and covered with grass, begin to wash right at the place where they would enter the creek. This wash would cause a small waterfall, probably not more than six or eight inches in depth, but the continuous wear under heavy rainfall would gradually make this fall a little deeper, and it would gradually work back toward the head of the canyon. These gulches would keep breaking down, and in a few rods this waterfall probably would become eight and ten feet in height. This has been the experience of the farmers in the Missouri River country, and all of this soil which is broken down in this way finds its way into the Missouri and Mississippi rivers. This is probably one of the sources, and the greatest source, of sediment washed finally into the Mississippi River. There is still another source of sediment coming from the Missouri River. This great river in times of flood will break through new banks, and in breaking through wash down a large amount of sediment and replace it upon the opposite bank or wash part of it on down the channel, but this source of washed sediment is not as great as the sediment which originally comes from the farms.

Now the question arises as to how best to handle the waters of these great rivers so that the public works will be the least expensive and permanent in their construction. Reading over the comments from various sources which have been printed in your paper, I have not hitherto noticed any comments relating to the question or subject of water-power. Permit me to suggest that in improving these rivers for the purpose of carrying away the water in flood times, the question of water-power should not be overlooked. I am informed that the Missouri River is underlain with solid rock. This rock is covered with a layer of quicksand and mud. If any person cares to study into this subject of water-power, they may soon find that the Missouri River is a much better foundation upon which to build improvements for this class of work. There are reasons for this. First, the banks of the Missouri River are more narrow and higher than the banks of the Mississippi. If this question could be properly discussed and the proper investigations made, I believe that the conclusion would be reached that the proper method of handling these rivers is in connection with the subject of water-power. Dams might be placed across the Missouri River holding the water up from twenty to forty feet at each dam, and this would hold back the mad rush of waters at flood periods, and in addition to that, every fall of water that might be obtained would be a source of water-power, and in addition to this water-power these dams might be so constructed that the Missouri River could be made navigable from the mouth of the river as far back as South Dakota. This would give opportunity for the shipment of millions of tons of freight from the ocean to the inland states. In addition to these works, these little streams and creeks, which wash out the farmers' fields and carry them down into the rivers, might be stopped by the placing of small dams where these breaks are found, and thereby prevent this large amount of sediment washing into the Missouri River. If you will take the time to look over this question, you will find that it is not so expensive to handle these rivers in this way as it would be to make great dikes and levees on the Mississippi River by which to carry away the flood waters. Now, in connection with this, I will suggest further to you the National Conservation Conference, which was held four years ago, and which made a report in three volumes, and the same was printed by the order of the United States Senate, showing that the available water-power in the United States amounts to about 230,000,000 water horse-power. If you will consult the United States census reports, you will find that the total amount of horse-power used in our industries throughout the United States amounts to about 18,000,000. We are now using in the United States in the several industries about one thirteenth of the available water horse-power which we now have and which might be utilized for future generations, if these rivers could be handled in the way that I am now suggesting, and the electric energy delivered and sold to the people of the country at $20 or $25 per horse-power per annum. The revenue derived from this source of income would be sufficient to pay all of the taxes of the general Government and of the states and the counties and the schools and all municipalities, and it would be a paying proposition to the Government from the day in which the first water-power could be placed in operation by the methods which I have suggested. Other writers do not suggest the utilization of these waters in such a way that they may be a source of profit to the country rather than a source of expense. We are approaching the time in this nation when the question of coal and oil is going to be a serious matter, and these water-powers should be utilized, and an investigation upon this question should be undertaken at an early date for the purpose of finding the real facts as they exist. I wish that you might go over this question, as I have suggested these matters to you, and I believe that if this question were placed before Congress in a proper way, they would be willing to appropriate a proper sum and appoint a competent commission to give this matter a most thorough consideration and find the best methods before we spend any money on actual construction.

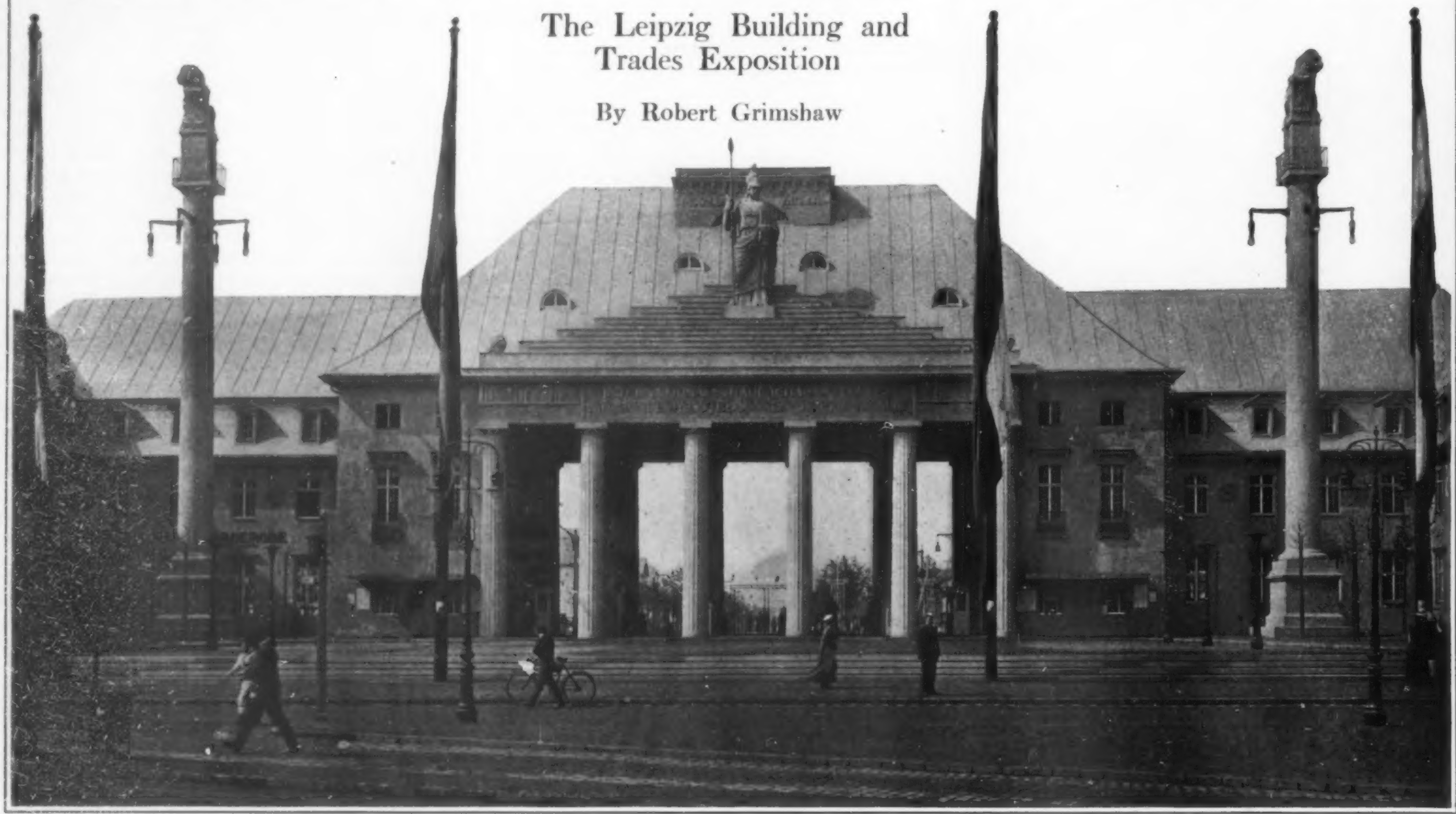
I believe that the greatest imperfection of the American people lies in the fact that they never apprehend a necessity until they are actually in need. That is our condition just at this time in respect to the conservation of our oil fields and the coal fields and these natural resources of water-power. I was before the Legislature this winter in the State of Nebraska, and undertook to impress that body with the importance of the question of water-power in this State. The question is new and has not been widely discussed, but we must meet the situation in the near future and take this subject up for discussion and utilize these water-powers for the conservation of our oil and coal. WALTER JOHNSON.

University Place, Neb.

A Remarkable Review of Building Methods Old and New

The Leipzig Building and Trades Exposition

By Robert Grimshaw



Entrance from the Reitzenhainerstrasse through the column portal of the Administration Building.

DEMONSTRATING the intimate relation between science and industry, a characteristic of modern national or international exhibits, the Leipzig Building and Trades Exposition, which opened the middle of May, to continue until the end of October of this year, is by far the most important attraction of the year in continental Europe, although it is also of world-wide interest.

This exhibition follows ideal rather than industrial lines, its object being to distribute new thoughts, somewhat as in Paris in 1900 the number of buildings in reinforced concrete showed the progress of French engineers in this line.

The grounds lie southeast of the city proper, and permit railway connection for the exhibits right up to the buildings. The greatest width of the exhibition grounds, that from one corner of the amusement part to the main entrance, is 2,624 feet.

Classes of Exhibits.

In the exposition there are eight main classes of exhibits, as follows:

I. The constructive arts: 8 groups, divided into 33 sub-groups.

II. Building literature, building-trade school, office furniture, 3 groups.

III. Building materials, their manufacture and use; 20 groups, 24 sub-groups.

IV. Machine tools and appliances in the building industries; 5 groups, 2 sub-groups.

V. Real estate and transactions in connection therewith; information and insurance; 5 groups.

VI. Building hygiene for dwellings, factories and streets; protection and welfare of work-people; fire-protection; 6 groups.

VII. Gymnastics, games and sports.

VIII. Tests of building materials; expert demonstrations.

The Scientific Department, to which over 50,000 square feet of surface is devoted, covers four departments as follows:

I. Scientific carrying out of construction.

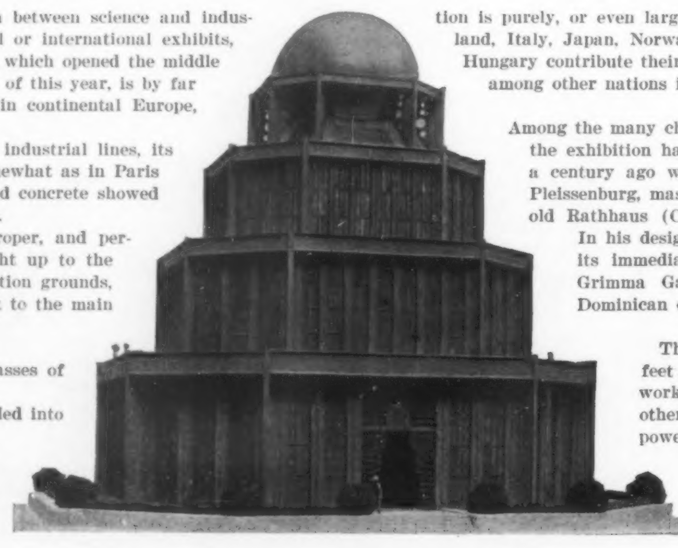
II. Artistic execution of above-ground constructions and their surroundings.

III. Scientific and artistic execution of collective building projects (city building, settlements, colonization).

IV. Hygienical and sociological precautions in the building trades, etc. (Protection of workmen.)

Many Countries Represented.

It must not be imagined for a moment that although Leipzig is no metropolis of trade or center of diplomacy, the exhibition is purely, or even largely, local. Far from it. America, England, Holland, Italy, Japan, Norway, Austria, Roumania, Russia, Switzerland, and Hungary contribute their share to the cosmopolitan picture, some of them among other nations in the scientific classes, some in special pavilions.



The Steel Building of the Steel Association.

The Dresden Building. An effective piece of architecture.

Old Leipzig.

Among the many changes in the rather monotonous landscape which the exhibition has wrought, is to bring back to the picture what a century ago was a prominent feature of Leipzig, namely, the Pleissenburg, massive and simple, with which, as well as with the old Rathhaus (City Hall) the history of Leipzig is interwoven. In his design Drechsler shows not only this old citadel with its immediate surroundings and the Peter's Gate, but the Grimma Gate and the adjoining University Church and Dominican cloister.

The Machinery Hall.

The Machinery Hall has an area of 55,500 square feet and contains all kinds of machines for making and working building materials; also overhead cranes and other transportation devices. The central light and power station, supplying the entire exhibition grounds with current, is located here; there are two Diesel motors of 1,120 horse-power each, direct coupled with two dynamos of 750 kilowatt-hour capacity.

Statistics in Building Operations.

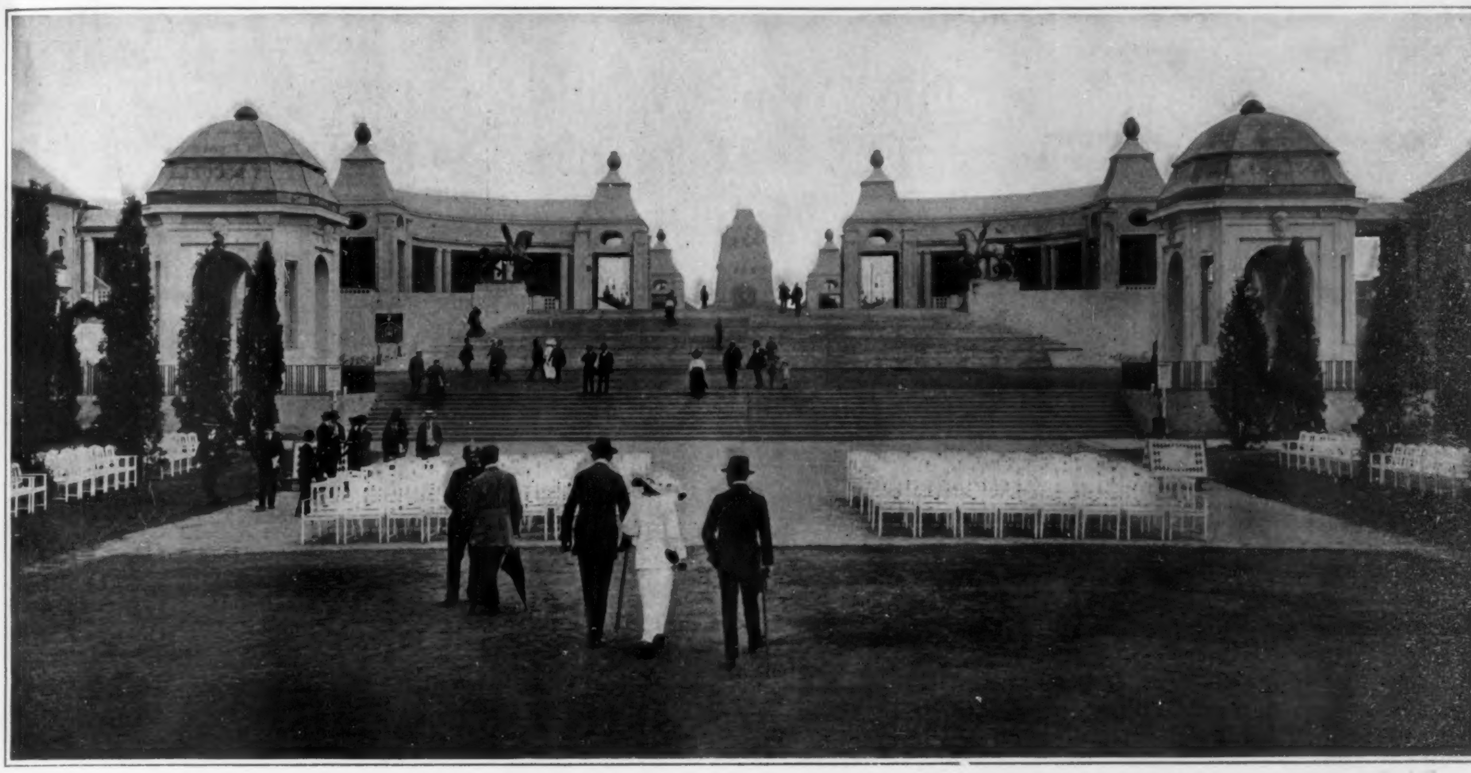
In order to show the importance of collecting statistics of building operations, there is a special exhibition in this line, particularly as regards engineering work and political economy. Engineering statistics, especially concerning foundation and overhead building, are well represented. Statistics concerning political economy are in charge of specialists. The engineer's share in the general work of civilization also comes in for representation.

The City of Leipzig Exhibit.

The city of Leipzig is taking a very active part as exhibitor in the exposition. There is shown by the municipality a project for the regulation of high water in the western portion of the city; the municipal systems of sewers, gas and water pipes and underground cables; graphical representations of the methods of laying out, paving, maintaining and cleaning the streets; the standard systems of design and construction of buildings; and very full graphical representations of the statistical, sanitary and other departments of the municipal government.

Government Buildings.

The Prussian government has a large



Terrace in front of the bridge over October 18th Street. Monument of the "Battle of the Nations" in the background.

collection of models and drawings of engineering construction—much more complete than at previous exhibitions. The Saxon State has its own pavilion, and besides this, an installation of safety appliances for railway purposes. Then the governments of Bavaria, Württemberg, Hessen and Elsass-Lothringen (Alsace-Lorraine) have special groups. Roumania has its own building.

The Saxon government building fronting on Linden Avenue covers about 10,000 square feet. In this building the state railways and the electric railway commission show a full and varied collection of material in their respective lines. Among other exhibits are models, drawings and photographs of new and old bridge constructions, the oldest tunnel in Germany (at Oberau), many railway stations and many novelties in signaling devices.

American Exhibits.

The city of New York is exhibiting models of the East River bridges, and of skyscrapers, models of dwellings of the rich, middle and poorer classes. There is a plan showing the building operations and a large photograph of the city as seen from the harbor. A further exhibit is the water supply and the public baths. Mr. Cass Gilbert, the architect, is displaying a model of his 53-story Woolworth building, the model itself being "Made in Germany." Mr. Hornbostel, one of the Carnegie engineers, has also sent a number of interesting models of buildings designed by him and erected in New York city.

Other American municipal exhibits are those of San Francisco, Chicago, Philadelphia and Washington. The American Bridge Company and the Canadian Railway Company also have exhibits.

Art in the Leipzig Exhibition.

The exhibition would be incomplete without a department for pictorial and plastic art; and in order that this may be both full, yet select and representative and worthy, the association of Leipzig artists has a display in two special rooms. They exhibit a selection of the pictorial and plastic art of the last thirty years. The importance and character of the exhibition may be judged from the names of some of those whose works are shown: Feuerback, Böcklin, Menzel, Hodler, Leibl, Stuck, Liebermann and Klinger.

Publishers and Booksellers at the Exhibition.

It is not to be expected that the head and center of the publishing and book-selling interests of Germany, if not of continental Europe, would be ignored in this, its typical industry. The technical literature of the building arts and those connected therewith is strongly represented, but in an entirely different and more extended manner from that adopted at previous international and local exhibitions.

Special Agricultural Exhibition.

Eastward from the amusement park comes the special agricultural exhibition, which is of great industrial interest and importance, especially as it shows the various types of structures used for all sorts of agricultural purposes in various countries and districts. In one particular, especially, is it worthy of notice—that of stables; for it has been proved that stable architecture and construction have great influence on the general health of the animals, and especially on their powers of resistance to infectious diseases.

View of the Grimma Gate and old Leipzig as it appeared one hundred years ago. The Fürstenhaus at the right.

The Garden City or Garden Suburb "Marienbrunn."

One special feature of the Leipzig exhibition is the Garden City or Garden Suburb, the development of which idea is taking place with more or less satisfaction and financial success in various countries and districts.

The present subject is a new and made-to-order "citylet" about a quarter of a mile from the main building of the exposition. It is designed and built according to proper sanitary, social, economical, technical and æsthetic principles. There are seventy-two houses, some for one family, some for more than one, renting for from M. 250 to M. 1,250 ($59.50 to $297.50) per year.

The present exposition at Leipzig may be considered in the light of a response to some of the suggestions brought out at the Dresden Hygiene Exhibition of 1911. Then it was shown how the inhabitants of a town or city are interdependent, while the present exhibit points out how the greatest good to the greatest number may be attained by organized endeavor through municipal and state institutions. A more extended article on the exposition appears in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT.

Effect of Radium on Plants

THE scientist H. Molisch finds that radium rays have the effect of interrupting the repose of winter buds of different woody plants and thus give rise to a precocious budding. Thus the terminal buds of the *Syringa vulgaris* when exposed to the effect of strong radium salts are found to develop soon after, and this even during the month of December, when the plant is cultivated in a hot-house. Untreated buds do not unfold, or at most this occurs much later. It is required to determine the time of exposure to the radium very exactly, and should this be too short there is no action produced, while a long exposure is injurious and even mortal. Radium effects are not felt either at the beginning or the end of the repose period. The emanation from radium is also used, and it acts even better than the rays from radium salts, as the effect is more diffused and uniform. When used at the end of November or early in December it will start the buds of *Acsculus hippocastanum*, *Staphila pinnata* and several other plants which were tried. Others like *Platanus orientalis*, however, give no results. Although the radium salts are too expensive to be used in practice for this purpose, the results are of interest, especially as strong rays from radium do not appear to have the same action upon plants in full growth as they have during the repose period.

Mixing the Danysz virus with grain. Fatal only to rodents.

The War Against Field Mice in France

By Jacques Boyer

Arsenic, barium carbonate, and bisulphide of carbon have been used with more or less success in destroying field mice and similar pests. The method now most favored consists in infecting mice with a contagious disease. In the following article the Danysz virus discovered at the Pasteur Institute of Paris and applied for this purpose is described.—EDITOR.

Placing virus-infected grain at the mouths of the burrows.

AT the present time France is overrun by field mice and their congeners to such an extraordinary extent that it has been found necessary to organize an official war of extermination against them. According to information collected by the Ministry of Agriculture the voracious and destructive rodents have invaded fourteen departments of France (Ain, Aisne, Ardennes, Aube, Belfort, Côte d'Or, Doubs, Haute-Marne, Jura, Meurthe-et-Moselle, Meuse, Savoie, Haute Savoie, Vosges). They attack all crops, devouring clover, lucerne and sainfoin as well as spring grain, beets and Jerusalem artichokes, and do not spare even the buds of isolated vineyards and young forest trees.

The most destructive of the rodents are the field rat (*Arvicola agrestis*) and the field mouse (*Mus sylvaticus*). At irregular intervals, as in the present year, these pests appear suddenly in immense numbers, in midsummer, and vanish as mysteriously, but not without leaving lamentable records of their visit. These formidable little animals have cost French farmers untold millions. Since the commencement of the nineteenth century they have made at least a dozen serious incursions, the most disastrous of which extended from the summer of 1801 through the autumn of 1802. In three departments the crops were annihilated and the meadows completely ruined.

A commission appointed by the Académie des Sciences to devise means of combating the scourge estimated the loss sustained by the single department of La Vendée at more than half a million dollars. In 1822 the rodents increased prodigiously in Alsace and more than two millions of them were killed in two weeks of the vigorous warfare waged against them. Many similar examples might be cited. The average annual loss caused by these field pests in France is estimated at forty million dollars.

In order to discover rational methods of combating these destructive animals it is necessary to ascertain the causes that give rise, intermittently, to their immense and often widely disseminated hordes. Formerly it was believed that the rodents were migratory, for in many instances few of them are seen in the year preceding a great invasion, and still fewer in the year after the invasion. But the observations of Crampe, Ritzoma Bos, and J. Danysz have made it certain that the members of even the densest swarm begin life very near the scene of their depredations. They may invade adjoining fields when they have exhausted the resources of their birthplace, but they never emigrate in great numbers. The intensity and suddenness of their visitations must be attributed to the extraordinary fecundity of these animals, which is increased by the numerical preponderance of females. Danysz has calculated that one pair of adults may produce, between February and the end of autumn, a progeny of 200 females and 100 males. Hence a rodent population of 150 (an almost inappreciable number) existing in a hectare of land (about 2½ acres) in February, may increase to 10,000 in July and to 20,000 in September by their normal multiplication.

Fortunately, the animals born in late summer and autumn do not attain their full development until winter, and most of them perish in the first severely cold weather. On the other hand, young litters and pregnant females are killed by late spring frosts, following several days of mild dry weather. The rodents are also continually hunted and destroyed by birds of prey and by moles, shrew-moles, hedgehogs and other animals.

Finally, when these various destructive agencies fail, the rodents perish in consequence of their own enormous increase. If they are too numerous in any place, they become weakened by lack of food and fall an easy prey to fleas, ticks and fungus parasites, which produce fatal epidemics in the active and voracious host.

These assertions are corroborated and a new light is thrown on the habits of these animals by the investigation, recently completed by MM. Guerrapain and Demolon, of their ravages in the department of the Aisne in the years 1909 to 1912. The serious depredations commenced in 1909 in two neighboring communes, whence the rodent swarm spread in all directions, like a drop of oil on water, but principally toward the southeast. These observations show that farmers should not wait with folded arms until their own fields are attacked, but should take energetic measures for the destruction of every focus of invasion, as soon as it is discovered.

Effective methods of destroying the formidable rodents have long been sought. At first, poisoning with arsenic was recommended. A mixture of arsenic and flour is stirred into a quantity of wheat moistened with molasses, and the poisoned grain is placed in drain tiles of small caliber which are distributed through the infested fields. Some writers advise placing the poisoned grain in the rodents' burrows and stopping the entrances with earth. This method yields imperfect and uncertain results, for the rodents often refuse to eat the poisoned grain, which they scatter around their holes, where it may be eaten by poultry and game birds. Arsenic, moreover, is intensely poisonous to all animals and to human beings.

It is better, therefore, to use the barium carbonate bread invented by Dr. Hitner of Munich. Four parts of cheap flour and one part of barium carbonate are mixed with water and yeast. The dough is allowed to rise and is baked in compact hard loaves about 1⅝ inches thick. The bread is soaked in skimmed milk or sprinkled with essence of aniseed and is broken into pieces as big as a hazelnut, one or two of which are put into each burrow. It is asserted that little more than one pound of bread to the acre is required to rid a field of rodent pests, so that this method is both cheap and effective.

In Denmark, in 1910, a method of destroying field mice with bisulphide of carbon was introduced by E. de Kruyff. All orifices of the burrows are stopped at night, and on the following night one or two cubic centimeters (thimblefuls) of bisulphide of carbon are poured into each new opening that the mice have made. After waiting a few seconds to allow the liquid to evaporate a lighted torch is applied to the hole. The bisulphide vapor ignites and explodes, filling the burrow with poisonous gases, which instantly kill its denizens. One pound of bisulphide of carbon is enough for more than 200 burrows. Although this method is very effective it is also very delicate and dangerous when applied by careless or inexperienced persons, because of the great inflammability of the bisulphide vapor. It is simpler and safer to pour about a quarter of an ounce of bisulphide into each reopened hole (all holes having been stopped the night before) and to close the hole without applying the torch. The poisonous

(*Continued on page 118.*)

Field-mouse (*Mus sylvaticus*).

Field-rat (*Arvicola agrestis*).

The shrew mole, which destroys other rodents.

Fire, Load and Water Test of Floor Arches

An Interesting Test in Which the Qualities of Gypsum, Terra Cotta Tile, and Reinforced Concrete Were Tested for Several Hours in Fierce Heat

The heat was so intense, it was necessary to open the doors with large iron rods.

Huge concrete firebox in which heat was kept at 1,700 deg. Fahr. for four hours.

AN interesting and conclusive demonstration of the fire resisting qualities of various building materials used in floor arches, was made on Wednesday of last week by Mr. Harold Perrine of Columbia University, at his testing station in Greenpoint, Long Island. There were three arches built especially for this test. One of these was built up of 4 inches of reinforced gypsum and shavings with a 2-inch cinder fill, another consisted of 10-inch hollow terra cotta tile with a 4-inch cinder fill, while the third arch was a 4-inch reinforced cinder concrete slab with a 2-inch cinder fill. In each case the cinder fill consisted of one part cement and ten parts cinders, while the concrete was composed of one part cement, two parts sand and five parts cinders. The reinforcing material in the gypsum and concrete arches was Clinton electrically welded wire with a 4 by 12-inch mesh.

The arches were each 5 feet 3 inches wide between the center lines of the beams, and 14 feet long, constructed over a 14 by 20-foot concrete firebox in such a manner that the under sides of the arches were directly exposed to the flames. In the walls of the firebox were six flues, three on each side, in order to provide a proper draft.

At 11 A. M. a hot fire was built on the grate and several workmen were kept busy piling in cord wood to keep the temperature up to 1,700 deg. Fahr. This temperature was recorded and maintained by the use of electric pyrometers, iron tubes being placed at various points in the roof or arches for this purpose. This was continued for four hours, readings being taken frequently by means of a surveyor's level, located on a nearby roof, for the purpose of ascertaining the deflection in the arches due to the intense heat.

It should be added that the arches were constructed in strict accordance with the requirements of the building department of New York city, and even the allowable load, to which floors are restricted, was added. This was done by piling pig iron on top of the arches, as is clearly shown in the illustrations, until the load reached 150 pounds per square foot. There were no partitions inside the firebox and each arch was subjected to the same amount of heat during the entire four hours of the test.

At the end of the four hours a division of the city fire department was on hand to extinguish the fire and cool the walls and arches. The firemen turned a stream of tremendous force against the hot firebox and floor arches and made short work of the fire. There was a water pressure of 60 pounds per square inch from a 1⅛-inch nozzle.

It was a surprise to many who witnessed the performance that the arches stood up as well as they did, considering the high temperatures and very sudden cooling to which they had been subjected. The terra cotta arch, which, of course, contained no reinforcing, stood the ordeal well, although not so well as the other two. The hollow blocks were considerably crumbled, but the arch did not give way, as was predicted by several of the witnesses after the test had been running two hours. It was also noted that this arch had deflected one inch from the level, while the others were undisturbed.

The gypsum arch was intact above the reinforcing steel, although it had crumbled away below this. Considering the nature of this material, and also that it was mixed with wood shavings, it stood up remarkably well, even with the 150 pounds per square foot of load. As was expected, the concrete arch showed no great effect from the ordeal to which it had been subjected. It had not even crumbled away from the reinforcing steel, and had showed no appreciable deflection.

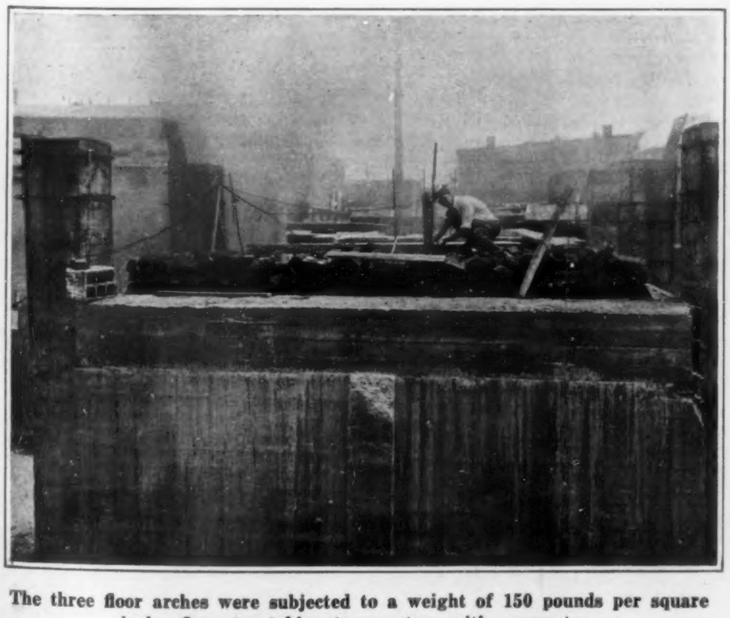
That the test was one of wide interest was shown by the fact that it was attended by more than a hundred men, including engineers, architects, contractors, and dealers in fire-proofing and reinforcing materials, as well as several representatives of engineering and scientific publications.

Gasoline Substitutes

LEWES in the *Chemical World*, 2,113, predicts that the waning supply of gasoline will very soon force the use of alcohol denatured with ten per cent of benzol. This will be safer, more pleasant to use and sweeter in exhaust than the gasoline of to-day. Though the calorific value of this mixture is only six tenths that of "petrol" or gasoline, the higher compression possible and increased explosive range will make it the ideal motor spirit. Benzol itself is being seriously considered as a substitute. It is twelve per cent more powerful in running than gasoline and English coke oven plants yield 8,000,000 gallons as a by-product. The commercial product containing, as it does, 150 grains of sulphur per gallon needs careful purification for motor use.

Sugar as a Surgical Antiseptic

IT has long been known that sugar was a disinfecting and preservative agent. The fact is even said to have been mentioned by Galen. But it is rather novel to learn from *La Revue* that an eminent German surgeon, Dr. Georg Magnus of Munich, who is famous as a traumatologist, recommends it strongly as a dressing for wounds. All saccharine substances are good, but pure cane sugar or beet sugar is best. Its disinfecting and sterilizing qualities are excellent. It is not injurious to the blood, as has been wrongly believed, and is a better preventive of putrefaction and contamination by microbes than ordinary medical antiseptics.



The three floor arches were subjected to a weight of 150 pounds per square inch. Operator taking temperature with pyrometer.

After the four-hour test firemen were called to extinguish the flames and to cool the arches for observation.

The Industrial Need of Technically Trained Men—VI

A Study of Incomes of Technically Trained Men

By David Edgar Rice, Ph.D., Secretary School of Science and Technology, Pratt Institute

IN the choice of a vocation, the probable income is naturally a factor of considerable importance. This factor is very often veiled under the more general term "opportunity," but opportunity means simply the active demand for the service offered, and where labor is concerned, this demand is usually expressed in terms of the wage.

Educational institutions that offer a variety of courses of training are frequently called upon by prospective students to give some statement as to the relative opportunities in different lines of work. Does electrical engineering offer a broader field than mechanical engineering? Is the mining engineer more likely to secure profitable employment than the chemist?

These and similar questions may be considered from a theoretical point of view, but as the proof of the pudding is in the eating, so the most direct and convincing answer to such questions is to be derived from a study of relative incomes, where accurate information is available.

The School of Science and Technology of Pratt Institute, Brooklyn, N. Y., has recently completed an investigation of this character. The data have been gathered from more than one thousand men who, within the past nineteen years, have completed courses in this school. These courses are two years in length and cover the fields of mechanics, electricity and chemistry. They do not profess to be engineering courses, but are rather of the so-called "industrial" type, offering technical and practical training intended to prepare young men for positions of responsibility above the grade of skilled mechanic in mechanical, electrical and chemical manufacturing and industrial plants.

The men enter these courses at an average age of from eighteen to nineteen years. Some of them have had three or four years of a high school course, but little or no practical experience. Many of them, on the other hand, have had a considerable amount of practical experience, but are without the preparation afforded by a secondary course of study.

The data here presented, therefore, indicate the earning power, which may, on the average, reasonably be expected by intelligent, capable young men in these industries who have taken two years to train themselves technically for the positions of more importance and responsibility than those of skilled mechanics.

The information was collected directly from the graduates themselves. Each graduate was asked to state his income, not in exact figures, but by means of code letters covering a fixed salary range. Below $1,500 each salary group had a range of $250. Above $1,500 the range was $500. The median of the range of each group was taken as the actual figure in making up the average. To this extent the figures here given lack absolute accuracy. The error possibly resulting from this cause was to some extent offset by plotting the average incomes of the different classes in graphic form, drawing a smooth curve through the several points, and taking off the averages from these curves.

The tables herewith given show the average incomes of the graduates of the several courses for each year after graduation, the average incomes of the 20 per cent of each class having the highest incomes, and the average of the 20 per cent having the lowest incomes. For the mechanical course, the so-called course in steam and machine design, the period since graduation ranges from half a year to eighteen and a half years. For the course in applied electricity the maximum period since graduation is fourteen and one half years, and for the applied chemistry course it is five and one half years.

In connection with these tables it must be borne in mind that the earlier classes are comparatively small in number, and that the returns from these classes also are less complete. The data for these classes are therefore somewhat less reliable, representing averages made up from the experiences of comparatively few individuals. For classes that have been out more than ten years, the number of men represented is less than twenty. For classes out less than ten years the number ranges from twenty to forty-five.

Table I gives the facts for the graduates of the course in steam and machine design, the oldest course in the school. Column one gives the average for the class. It shows that at six months after graduation, when practically all members of the class may be presumed to be fairly well settled in their positions, the average income is approximately $875. For a period of about ten years after graduation the annual rate of increase is practically uniform, and is, on the average, about $140. At this point it becomes noticeably less, being reduced to an average of approximately $100. It is, however, interesting to note that even to the last there is a constant increase in the annual income, indicating that the men who have been out in practical work for more than eighteen years since their graduation have not yet begun to reach a limit to their earning capacity—a very strong argument in support of the advantages of technical training.

The second and third columns give the average incomes, respectively, of the higher fifth and lower fifth of the several classes. They serve merely to show the salary range and call for no special comment.

Table II gives the corresponding facts for graduates of the course in applied electricity. The average income for the entire class is practically the same as for the graduates of the mechanical course, except that the initial income is slightly less. This difference, however, disappears within the first two years.

A comparison of the figures for the upper and lower fifths of the classes shows that the range for the electrical course is considerably less than for the mechanical. While the incomes of the more successful electrical men do not run so high as those of the more successful mechanical men, the averages for the less successful, on the other hand, do not reach so low a level.

A comparison of the average incomes for these two courses is interesting in connection with the question as to which field, the mechanical or the electrical, offers the better opportunities for advancement. The prevailing impression, at least among young men who find it necessary to make a choice, seems to be in favor of the electrical field, but the facts here presented do not support this view.

Table III summarizes the facts for the course in applied chemistry. This is the most recently established course in the school, and had only six classes of graduates at the time this information was gathered. The striking fact in connection with this table is the rapid rise of the average salary in comparison with that of the other two courses. Although the initial income is practically the same for all three courses, the chemistry graduates reach the $1,500 point almost two years earlier than do the graduates of the other courses, and they reach the $1,900 mark almost three years earlier.

In explanation of the better showing made by the chemistry graduates, several factors are to be considered. In the first place it seems to be the fact that the training in industrial chemistry can be made more specific than in mechanical and electrical lines, so that the chemical graduates immediately after completing their course are more likely to find work for which their training has definitely fitted them. The training of mechanical and electrical men, on the contrary, must

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry *may* be repeated.

MUNN & CO., INC.

Inquiry No. 9312. Wanted to buy a machine which will pick up a weight the size of a lima bean by vacuum process. Must be able to pick up dust, gravel, etc. Must be operated by electricity and be easily portable.

Inquiry No. 9313. Wanted to buy Leather Held Horse Shoes used temporarily when shoe cannot be nailed on. In other words a Leather Boot with iron shoe at bottom—strapped over horse's foot.

Inquiry No. 9314. This enquirer is in the market for some patented articles which he could purchase and manufacture with an investment of from $5,000 to $10,000. The name of the party will be supplied to any of our readers on application.

Inquiry No. 9315. Wanted the name and address of a concern manufacturing novelty ink wells.

Inquiry No. 9316. Wanted the names of manufacturers and manufacturers' agents who make patented articles and other useful devices which appeal to the public and which can be used in a mail order business and by canvassers.

Inquiry No. 9317. Wanted the names and addresses of manufacturers of good selling articles that would appeal to the public where exclusive sale in certain territories can be arranged for; both to sell to the trade and through sub-agents in a house-to-house canvas.

Inquiry No. 9318. Wanted rollers and other appliances for extracting water and moisture from refuse, such as coir dust, with special reference for using it as a fuel.

Inquiry No. 9319. Wanted the name and address of concerns manufacturing novelties in table or pocket cutlery for the wholesale or mail order trade.

Inquiry No. 9320. Wanted an article suitable for large manufacturing—plant equipped for making Boats, Marine Engines, etc. The plant would be capable of making almost any article. A large wood-working establishment is also operated in connection with the metal shops.

Inquiry No. 9321. Want name and address of a firm who could make a machine for turning out rat buttons. The machine must be capable of making the dough of the exact size required, and also a machine to manufacture the tins and a machine for placing the dough in the tins. Preferably this machine should do all of this work in one operation.

be more general in character, so that some sort of preliminary apprenticeship is necessary before they can develop a high degree of efficiency.

In the next place it is undoubtedly true that the supply of men trained for work in industrial chemistry is considerably less than in the mechanical and electrical fields. It is only recently that the possibilities of the industrial chemistry field have begun to be realized. Comparatively few institutions offer courses in chemical engineering, and comparatively few men graduate from these courses.

Another factor to be considered is that in the chemical fields the transition from the status of employee to that of employer or proprietor is probably easier. The business of manufacturing chemist on a small scale may be established with much less capital than is usually required for enterprises of similar character in mechanical and electrical lines.

In comparing the facts given in these tables with corresponding data from other institutions, it should be borne in mind, as has already been pointed out, that these are not engineering courses, but two-year courses of practical character, intended to give the essentials of a technical education to men who have had but little preliminary training, and who as a rule are compelled by circumstances to work their way upward from the ranks.

TABLE I.

Average annual incomes for mechanical men.

Period after Graduation.	Average of class.	Highest fifth.	Lowest fifth.
Six months	875	1,250	700
One year	940	1,375	710
Two years	1,075	1,575	750
Three "	1,225	1,810	850
Four "	1,375	2,050	925
Five "	1,500	2,300	975
Six "	1,650	2,500	1,010
Seven "	1,775	2,750	1,075
Eight "	1,925	3,000	1,150
Nine "	2,075	3,200	1,225
Ten "	2,225	3,425	1,275
Eleven "	2,325	3,650	1,320
Twelve "	2,425	3,825	1,375
Thirteen "	2,525	4,000	1,425
Fourteen "	2,625	4,150	1,500
Fifteen "	2,725	4,275	1,575
Sixteen "	2,825	4,475	1,625
Seventeen "	2,900	4,550	1,675
Eighteen "	3,000	4,675	1,750

TABLE II.

Average annual incomes for electrical men.

Period after Graduation.	Average of class.	Highest fifth.	Lowest fifth.
Six months	840	1,185	675
One year	900	1,325	690
Two years	1,075	1,500	750
Three "	1,225	1,750	825
Four "	1,375	1,950	925
Five "	1,500	2,150	1,000
Six "	1,650	2,375	1,100
Seven "	1,775	2,575	1,150
Eight "	1,925	2,775	1,250
Nine "	2,075	2,975	1,325
Ten "	2,200	3,200	1,400
Eleven "	2,300	3,375	1,450
Twelve "	2,385	3,525	1,475
Thirteen "	2,450	3,700	1,500
Fourteen "	2,500	3,825	1,550

TABLE III.

Average annual incomes for chemical men.

Period after Graduation.	Average of class.	Highest fifth.	Lowest fifth.
Six months	875	1,075	675
One year	950	1,320	720
Two years	1,215	1,815	815
Three "	1,440	2,275	940
Four "	1,675	2,750	1,075
Five "	1,900	3,200	1,175

Neglected Subjects in Medicine

ANYONE who turns the pages of the huge Index Catalogue of the Library of the Surgeon-General's Office, United States Army, of which 23 volumes have been published up to date, and which is a practically exhaustive catalogue not only of medical books, but of articles in the medical journals of all countries, might gather the impression that every medical topic of the slightest importance had been fully investigated and written up. This is, however, by no means the case, for many such topics of very considerable importance have been almost completely neglected. We recently called attention in these columns to the fact that hardly anything is known about the nature and causes of "astraphobia;" i. e., the pathological effects experienced by many persons before and during thunderstorms. An analogous case is that of "aelurophobia," or morbid antipathy to

cats. What little is known, scientifically, on this subject is almost entirely due to Dr. Weir Mitchell, and his rather fragmentary investigation of the matter is comparatively recent; whereas the condition in question, like that connected with thunderstorms, is neither novel nor unfamiliar in its non-scientific aspects; probably there are few readers of this journal who do not number several "ailurophobes" among their acquaintances. How does it happen that there is not an extensive literature on both these topics? Another subject that has been greatly neglected is dermatitis venenata, especially in connection with plants. Dr. J. C. White's book on this subject, published in 1887 and now out of print, is the unique monographic treatment of the question. How many people, even in the medical profession, realize that upward of 60 common species of plants growing in the United States are more or less poisonous to the touch? The attention of the public, in this connection, has been strangely monopolized by poison ivy and its congeners.

Field Mice

(*Concluded from page 114.*)

bisulphide vapor kills most of the mice and the destruction is completed by repeating the application, on the following night, to the few holes that are again found open. This process may require eight or nine pounds of bisulphide per acre. The suffocation of the rodents by filling their burrows with sulphurous acid and other gases requires the use of cumbrous and not very effective apparatus.

The method of destroying rodent field pests which is now most favored consists in infection with a contagious disease. In Germany the Loeffler virus is used. In France, the Danysz virus has been adopted after many experiments. The Danysz virus, which is nearly related to Loeffler's, is prepared at the Pasteur Institute and also by departmental veterinaries. Its germ is a bacillus of the coccus type (*B. Typhimurium*), which Danysz found in the bodies of field-rats, in 1893.

Experiments continued through several years have led Danysz to recommend the following method of employing it: The virus, diluted with salt solution, is mixed with rolled oats or crushed wheat or barley and allowed to ferment for three or four hours. A small quantity of the mixture is then placed near each orifice of the burrows. The virus is supplied in little bottles, each of which, with 22 pounds of grain, ½ ounce of salt and 7 pints of water, suffices for the treatment of one hectare (2½ acres). The period of incubation of the disease is ten days, and the mortality is 85 to 95 per cent if fresh virus has been used. Virus more than four days old, on the contrary, not only fails to kill the rodents, but it "fattens" them, as the farmers say. Denon has proposed to assist the action of the virus by adding barium carbonate to the infected grain, but this proceeding has not been generally adopted, while the employment of the Danysz virus alone has received both popular and official sanction in France, and also in Tunis, Hamburg, Copenhagen, and elsewhere.

The virus can be obtained without difficulty from the Pasteur Institute, where a special laboratory, which can furnish several thousand bottles of virus per day, has been established. The French railway companies have agreed to forward the virus by fast trains at a very low tariff. The cost of treatment, therefore, does not exceed fifty cents per acre. This method, which is the only one recommended in the latest circular of the Ministry of Agriculture, possesses the great advantage over all others that the grain infected with Danysz virus is harmless to domestic animals, birds and the men who distribute it.

If satisfactory results are not obtained in two weeks, however, Guerrapain and Demolon advise the employment of arsenic, and if this also fails, the use of bisulphide of carbon, two weeks later, or treatment, by successive zones, including hedges, groves and other lurking places, in addition to meadows and fields.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

SANITARY BELT AND PAD.—AUGUSTA SCHULZ, 128 Broad St., Westfield, N. J. This invention relates to ladies' apparel apparatus, and has particular reference to pads or attachments having in view the neatness of appearance of the wearer, and also in view a device which may be used in sick rooms or hospitals for preventing soiling of bed or the like during surgical operations and sickness.

Of General Interest.

FILING APPARATUS.—J. A. BEST, Augusta, Ga. The present invention relates generally to filing systems and more particularly to those of the character described and claimed in Mr. Best's application serially numbered 664,058. The specific improvement presented by his present invention resides in the provision of cards having means whereby they may be engaged with selected supporting and holding members of a series, whereby the cards may be arranged in a non-alined series wherein a portion of each card is exposed along certain of the edges of the next adjacent card in front thereof. This enables the cards to be distinguished and selected in a short time and without fingering over numbers thereof as in the usual indexing systems.

PORTABLE BOOTH.—WILLARD J. PRICE, 85 Utica Ave., Brooklyn, N. Y. The construction embodies a style of booth section which may be made up in large numbers, and when a fair, bazaar, or other display is contemplated any suitable number or arrangement of such sections may be used to make up the required number of booths. By this arrangement it is feasible for one engaged in the business of fitting up bazaars or the like to be equipped with a suitable stock of booth elements and for such party to attend to the designing and erecting of the booth equipment according to needs of any special occasion. The complete erection is accomplished without the use of nails or screws. This patent is for sale.

Heating and Lighting.

CANDLE.—T. A. LYNCH, 965 E. 167th St., Bronx, New York, N. Y. This invention provides a means for preventing the burning of candles below a pre-determined section thereof. The candle burns until the wick is consumed to the support and holding end thereof. The unconsumed portion of the wick is held suspended and prevented from following the melted wax below the holding portion of the support. Means suspend the capillary action of the wick and the light of the wick therefore fails.

Machines and Mechanical Devices.

REGISTER GAGE FOR PRINTING PRESSES.—J. STIVERS, 687 Fifth Ave., San Francisco, Cal. The invention more particularly relates to means for automatically registering the paper or cards to be printed, whereby the work is improved in appearance and the output possible over printing apparatus not so equipped is materially increased, it being possible to operate the press at a much higher speed and yet insure perfect accuracy of adjustment of the work.

Railways and Their Accessories.

DEVICE FOR AUTOMATICALLY CLOSING LOCOMOTIVE VALVES.—T. W. GRIFFIN, Springfield, Mo., and C. J. RATHERS, 211 S. Oak St., Sapulpa, Okla. The invention relates to valved fittings of a locomotive, and more particularly to those fittings, including valves which are normally open and which communicate with parts likely to be broken as the result of an accident, such as collisions, the aim being to provide corrections by which the certain valves may be automatically closed simultaneously with the application of the emergency air brake.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

WE wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

We also have associates throughout the world, who assist in the prosecution of patent and trade-mark applications filed in all countries foreign to the United States.

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